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THE
GEOGRAPHICAL REVIEW

VOL. VIII JULY, 1919 NO. 1

THE WORK OF FRANCE IN MOROCCO

By ALFRED DE TARDE
Editor of *France–Maroc*

Morocco of the old days is passing. Pierre Loti's sleeping Maghreb, "impenetrable to things that are new," awakens to a vitality that a recent American visitor has declared reminiscent of the Far West. This new Morocco is the creation of one man—General Lyautey. Named Resident General in April, 1912, after the signing of the French protectorate treaty with Morocco, General Lyautey has held this office without intermission save for four months (December, 1916-April, 1917) when called to the Ministry of War.

POLITICAL EVENTS

To appraise his work at its proper value the recentness of the events must be borne in mind. It was in 1907 that the first French troops were disembarked at Casablanca to establish order and to protect the European residents. At the time Morocco was under the régime of the Act of Algeciras (1906), that is under an international protection, with policing duties specially devolving on France and Spain, an agreement, however, which proved impotent to suppress anarchy. France found herself compelled to resort to military intervention, thereby arousing the opposition of Germany. There followed a series of events concluded by the accord of November 4, 1911, with Germany and, shortly afterwards (March 30, 1912), by the above-mentioned protectorate treaty with Morocco. Seven years have elapsed since the date which gave France the right to act in Morocco—that is in her sphere of influence as delimited by previous agreement with Spain. At the time when France took up the work of political and economic organization everything remained to be done—restoration of the disordered administration; establishment of the bases of economic development; installation of medical, educational, and other service; reform of the land system. At the same time peace had to be

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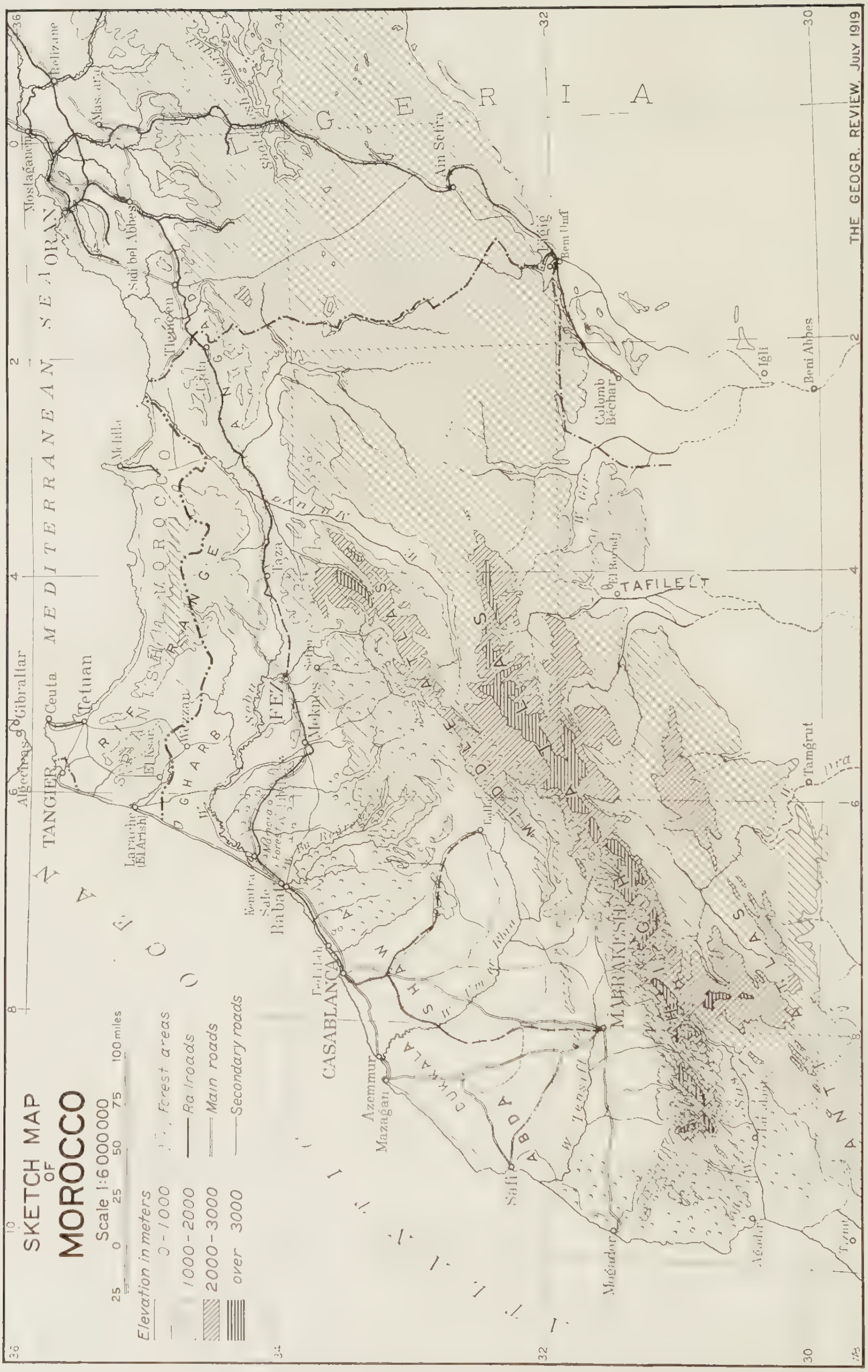

FIG. 1—Sketch map of Morocco showing the natural features and the means of communication. Scale, 1:6,000,000.

assured and a rebellious population pacified by the combined application of force and persuasion.

The task was immense in itself. It was rendered still more difficult by the course of external events. Two years after France had taken up her task the European war broke out. Should the work in Morocco be suspended? So some thought in the stress of the first days. There was a call for immediate abandonment of all the country except the coasts. But General Lyautey, with a clear outlook on the future, answered differently. He despatched to France the forces summoned for national defense, guaranteeing to hold Morocco with the remainder. As a protective shield he flung the last of these active troops to the borders of the pacified territory, trusting the peace of the interior to a policy of public works and general development.

This policy he has applied without relaxation since August, 1914. Its success is patent, for not only has Morocco remained peaceable during the war despite the efforts of German propaganda but the zone of pacification has been extended. Today the occupied area exceeds 250,000 square kilometers where at the outbreak of the war it was 180,000 square kilometers.[1]

General organization of the country has kept pace with military events. The advance of the army has been strikingly co-ordinated with the civil work, which we now proceed to discuss. Morocco affords a convincing example of what can be accomplished through the vigorous prosecution of a policy well defined and firmly fixed along broad lines.

THE CIVIL CONQUEST

The fundamentals of this policy must briefly be noted, for they illuminate the entire field of French work in Morocco—even more, they reveal the difference between that nation's general colonial policy, sometimes, but unjustly, described as French imperialism, and German imperialism. In a tractate "Le rôle colonial de l'armée," written in 1900 after experience gained in Madagascar, General Lyautey laid down certain principles of colonial warfare. Principle and method are expressed in the short formula: *L'armée aux colonies, c'est une organisation qui marche.*

Occupation is not effected for the sole profit of the conqueror but has due consideration for the conquered. The advancing army leaves behind it elements of established order; extension of conquest and extension of order are in fact synonymous. In colonial warfare the offensive has a particular character. It takes careful cognizance of the sources of future well-being and limits destruction to a minimum. The village taken at the point of the sword today may be the market of tomorrow. Operations are naturally conducted on different lines when the campaign is merely

---

[1] See the note on "The French Penetration of Morocco," with map, in the Geographical Record in the present number. For a recent general article on Morocco under the French régime, see also: A. Brandes, Marokko, *Tijdschr. Kon. Nederl. Aardrijk. Genoot.* Vol. 36, 1919, pp. 306-327, with map.—EDIT. NOTE.

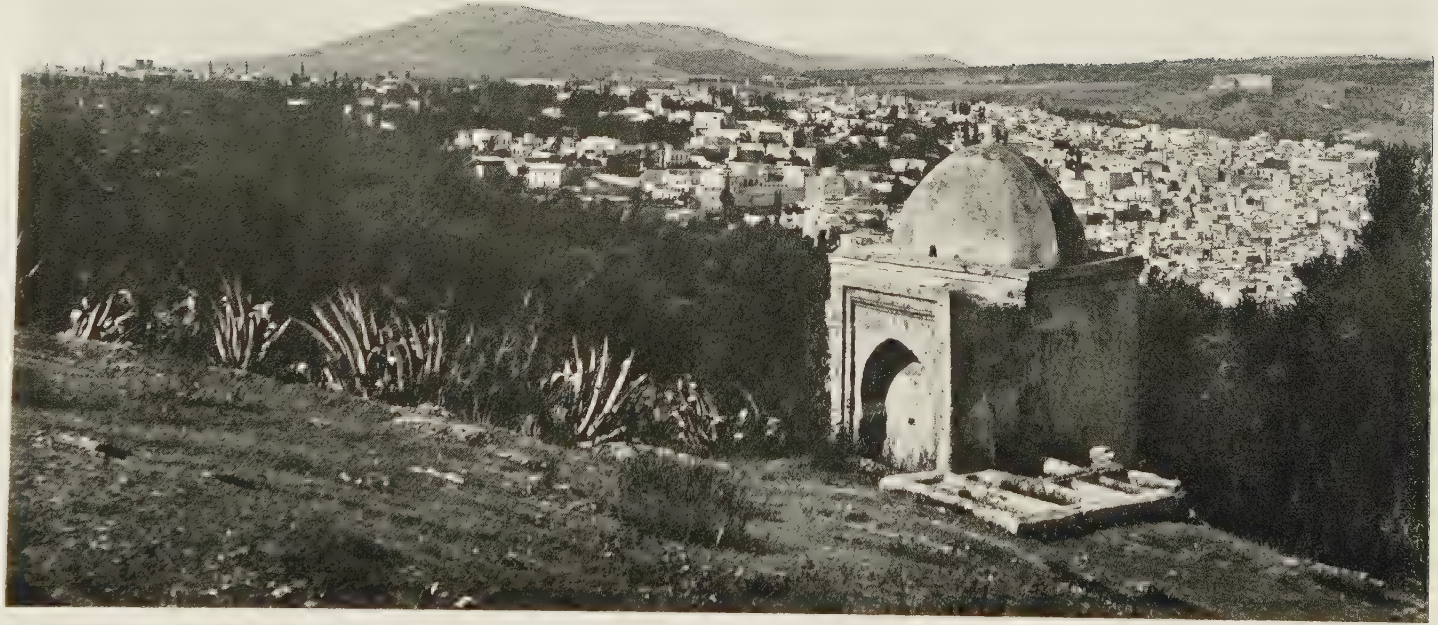

FIG. 2–Panoramic view of Fez, the most beautiful and interesting city of Morocco. Since its foundation at the beginning of the ninth century this "holy city" has played an important part in the history of the country. "How large, how populous" its state in the early sixteenth century Leo Africanus has described in his history of Africa (*Hakluyt Soc. Publs.*, First Series, Vols. 92, 93, 94, 1896). The location of the city in the strategic and commercial passageway connecting the Mediterranean and the Atlantic between the Rif Range and the Middle Atlas ensures its future progress.

one of invasion and conquest from those employed in a campaign to open a road of future commercial penetration. Morocco furnishes an excellent illustration in the narrow-gage lines constructed for military purposes but not the less adaptable for subsequent commercial use. In the building of such lines connection between the chief economic centers has been kept in view.

Under this conception the army is not merely a unit designed for combat but a complete society in miniature. It embraces not only soldiers but workmen of all trades—masons, carpenters, laborers, farmers, teachers, doctors. In Morocco, for instance, the army has constructed posts, built roads and bridges, and established railways and telephone lines—in fact has completely prepared the way for economic organization.

In place of the old idea of conquest has been substituted that of co-operation with the native peoples. The occupying force, having in mind pacification and enrichment of the country for the natives no less than itself, has respect for the established authority. Instead of wasting its efforts to replace existing organizations by new systems naturally mistrusted by the people, it is satisfied to re-enforce them by wise control.

The Administrative Organization

When the protectorate treaty was signed Morocco was submerged in anarchy. The power of the Sultan was on the wane; most of the country with the exception of Fez, Meknes, and the coast was in rebellion against him. After affixing his seal to the treaty Sultan Mulai Hafid abdicated, and the Makhzan (Moroccan government) nominated his brother, Mulai Yusef, as his successor.

The Sherifian Empire is a theocratic state. The Sultan, as ''Descendant of the Prophet'', enjoys absolute power; his religious authority is one with his political authority, as the religious law is not distinguished from the civil law. The Sultan governs with the aid of his ministers, or viziers, at the head of whom is the Grand Vizier, charged with internal affairs. The entire administration of the country proceeds from the court of notables who assemble every morning in the Sultan's palace, each sitting in his little *benika,* or audience chamber, opening off the principal court.

This administration has been preserved in its original form by the French authorities. The Sultan retains all his prerogatives; he exercises his office with all its traditional apparatus. The personnel of the palace, the Sherifian family, and the royal harem are maintained by a civil list of 3,500,000 pesetas. The viziers also continue their functions according to past custom. But certain of the old offices of the Makhzan have become obsolete; for example that of the Vizier of Foreign Affairs. His seat is now filled by the French Resident General, the sole intermediary between the Sultan and foreign powers. Furthermore, several technical depart-

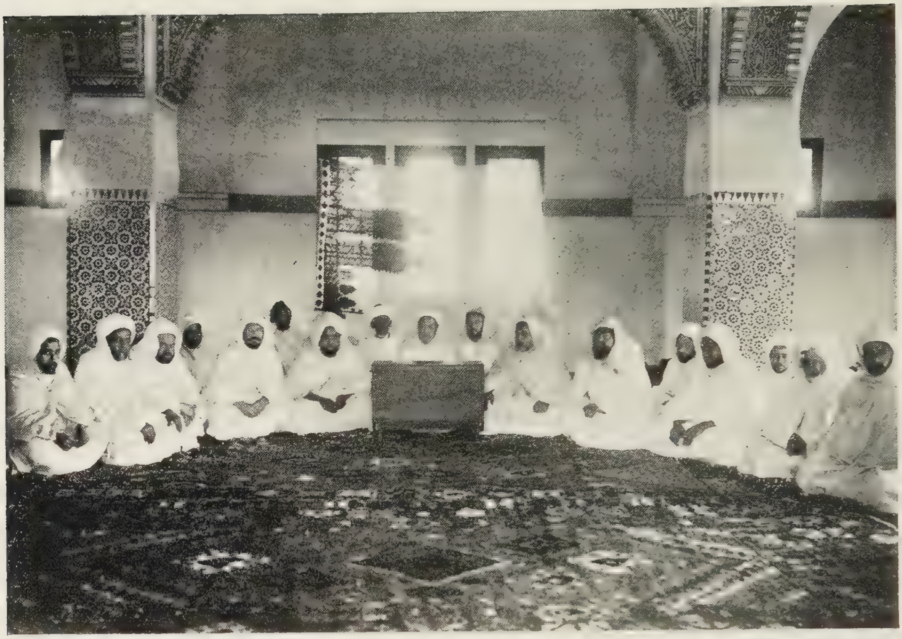

Fig. 3

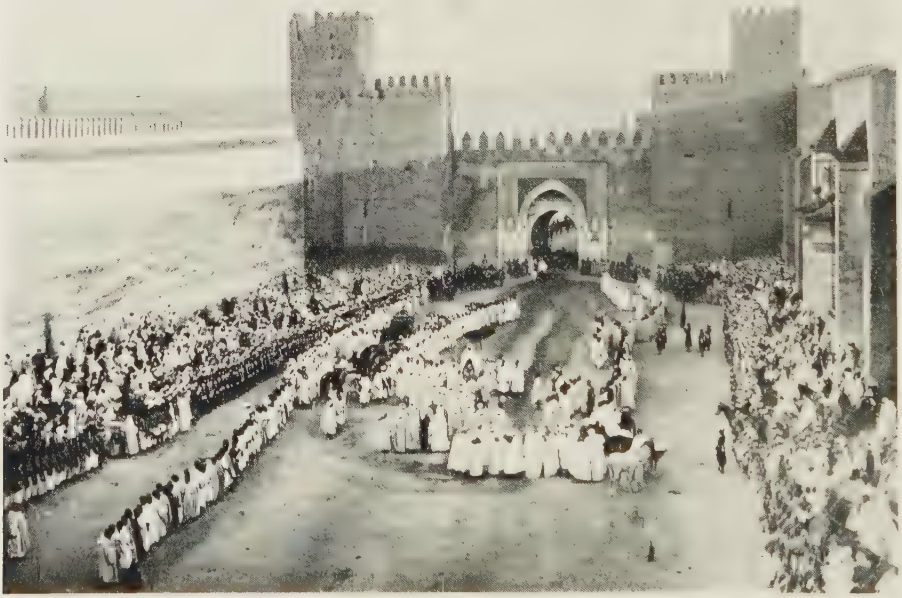

Fig. 4

Fig. 3—The administrative council, or Makhzan, of the Sherifian Empire, one of the last vestiges of the régime of the Middle Ages. While the protectorate has preserved the original form and apparatus of government, new offices provide for the development of the country.

Fig. 4—The Sultan receiving presents according to custom from townspeople and tribesmen. The ceremonial of such occasions is described by Aubin in "Le Maroc d'aujourd'hui" (1904).

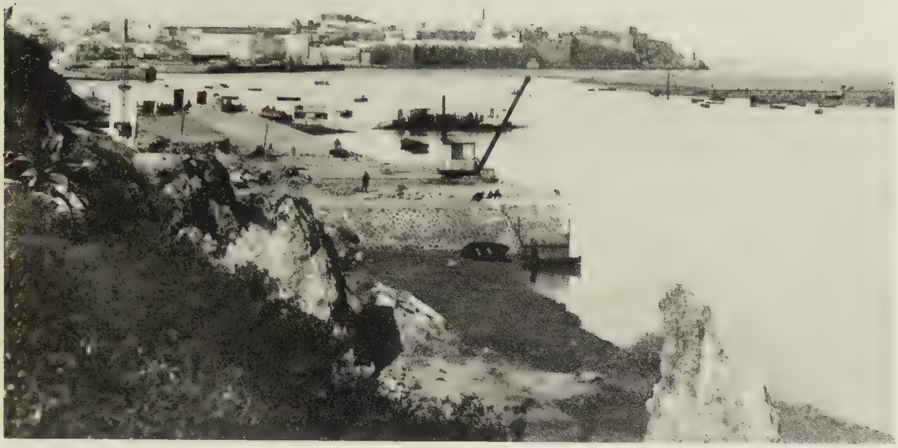

Fig. 5

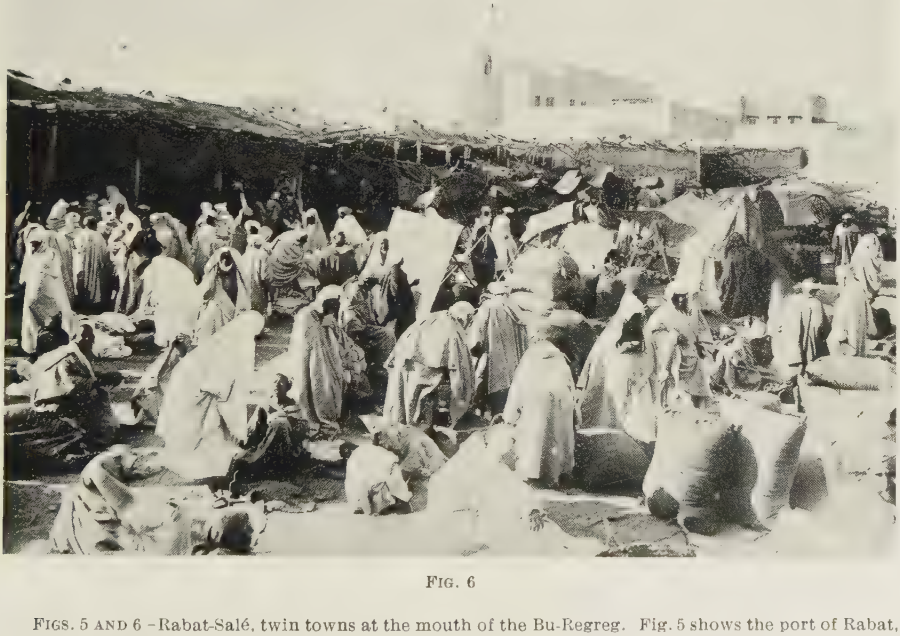

Fig. 6

Figs. 5 and 6 –Rabat-Salé, twin towns at the mouth of the Bu-Regreg. Fig. 5 shows the port of Rabat, now in the course of improvement. The opening of new quays has already augmented the trade even during the war. Facilities will be greatly enhanced by the projected dredging of a channel across the estuarine bar. Fig. 6 shows a market at Salé. Everywhere in Morocco, where modern trade methods are just appearing, the periodic markets and fairs are scenes of great activity socially and politically as well as commercially.

ments have been created—such as those of Public Works, Public Lands, Finance, Agriculture, and Postal Service. These are entrusted to French functionaries, who thus in reality serve as Sherifian ministers. Administration of the towns remains with the pashas, delegated by the Sultan, and those of the tribes with the *kaids*.

As remarked above, in the native system of justice the religious and civil law are identified. In all personal matters, such as marriage and inheritance, judgment is given according to the customary law (*shrâa*) drawn from the Koran. The judge (*kadi*) himself receives official recognition only under the appointment of the Sultan.

What, then, is the rôle of France in Morocco? That of supervision only. By the side of the organizations maintained or restored authorities have been installed who are charged with powers of surveillance or are authorized if necessary to furnish suggestions and advice. Acting side by side with the Makhzan is the Secretariat General with its three departments—of the Interior, of Justice, and of the Religious Estate (*habûs*, inalienable properties)—which are in permanent relation with the corresponding ministries of the Makhzan. Associated with the pashas, the kaids, and the kadis are the intelligence officers (*officiers de renseignements*) for the territories still under a military régime and the civil controller for the pacified regions under civil administration. We must pause for a moment over the former office for it is the most distinctive feature of the French protectorate system. Under other forms it also exists in Tunisia and Algeria.

The officer of this intelligence service is at once a military man, a diplomat, and an administrator. His rôle, especially on first installation, is to become acquainted with the people, to gain their confidence, to make them forget the call of the old freedom in the advantages of their present situation. At the same time he must sow the seed of pacification in the unconquered territory. Later his rôle becomes more administrative and then he acts as counselor. He reorganizes justice and instruction, establishes medical assistance, aids the agriculturists. The service thus calls for a man of unique ability who is furthermore a master of *finesse;* he must be omniscient—to the extent of having a knowledge of Berber dialects as well as a perfect knowledge of Arabic; but most of all he must have an understanding of the workings of the native mind. This service may be described as the keystone of France's Moroccan policy.

It may also be added that in the large towns the native municipalities (*medjless*) have been reorganized and that these assemblies, presided over by a French officer, conduct their own affairs. Among the tribes the assemblies of headmen (*djemâa*) have likewise been reconstituted, and to them great powers have been entrusted.

This liberalism in the political administration of the country is not a feint. It is implicit in the objective of the protectorate—the development of the territory. Industrial and commercial life can only take root and flourish under conditions of general security.

Economic Equipment; the Ports

One of the first measures in establishing the protectorate was the drawing up of a scheme of economic policy, including a program for public works. Though the pacified area was then of small extent, the program was large in scope, for it looked to the future and, moreover, the order was to move quickly. The problem of the ports, the economic keys to the country, naturally demanded first attention. To avoid dissipation of efforts and resources there was adopted the principle of "one major port, several secondary ports." Choice of the chief port fell on Casablanca. Thither European commerce was directed for the most part, and interests acquired there were already considerable; furthermore it is the natural outlet for the rich regions of the Shawia (Fr., Chaouia) and Tadla. The project for Casablanca, for which the sum of 44,000,000 francs was appropriated, includes a great pier 1,900 meters long, which shall afford protection against the heavy seas characteristic of most of the western coast of Morocco, and a second pier 1,550 meters long transverse to the first. The anchorage area thus enclosed will measure some 140 hectares with a depth of over ten meters. Provision is also made for enlargement. Inside the

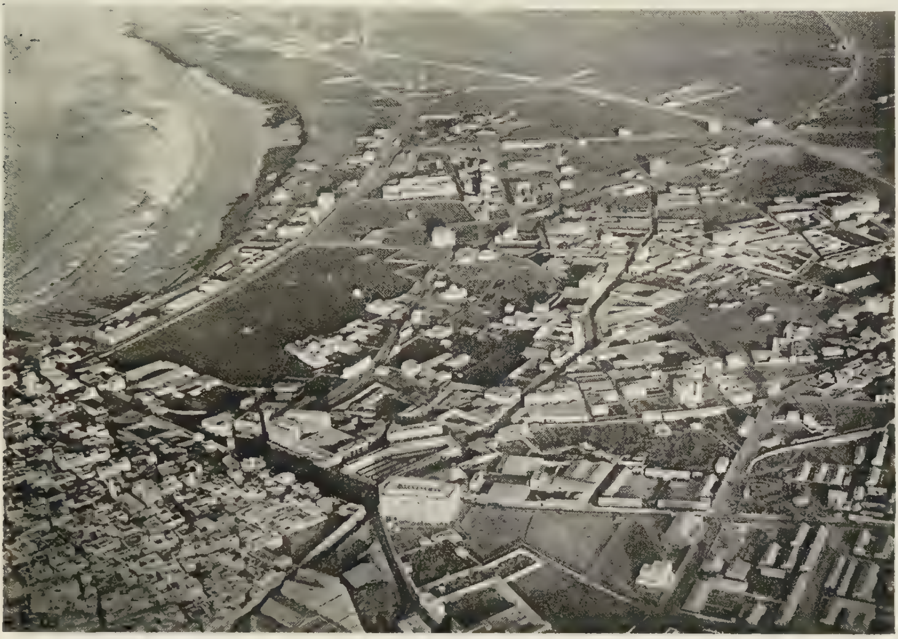

FIG. 7—Airplane photograph of the eastern, or European, section of Casablanca, the first port of Morocco.

outer port is a small harbor, 9½ hectares in extent, for small vessels.[2] Construction of the larger pier, the principal part of the work, was begun first; today it is half completed, progress having been slackened through the difficulty of obtaining material, especially cement. The small inside harbor is already in working order. When the entire plans are completed Casablanca will be able to accommodate a traffic of 1,500,000 tons (metric). Is this an overestimate? It hardly seems so, for the present traffic in spite of the war exceeds 200,000 tons, and the progress accomplished in the period before the war is most encouraging, as is shown by the following figures:

1910	43,336	tons
1911	68,632	‘‘
1912	98,536	‘‘
1913	241,800	‘‘

In value of merchandise the progress of the commercial movement is not less suggestive:

1910	24,310,000	francs
1911	41,915,000	‘‘
1912	63,280,000	‘‘
1913	79,371,000	‘‘
1916	107,963,000[3]	‘‘

The future of Casablanca is regarded with satisfaction by those who appreciate the importance of its situation on the Atlantic coast. When Casablanca is joined by rail to Tangier on the one hand and Oran on the other it will become a terminus of an Old World line to Central and South America—at least until the Trans-Saharan line reaches Dakar—for travelers who wish to shorten their journey by several days.

Besides the development of Casablanca the program of public works includes improvement of the local ports of Kenitra, Rabat, and Fedalah in the north, and of Mazagan, Safi, and Mogador in the south.

Rabat and Kenitra are neighboring ports, the former situated on the estuary of the Bu-Regreg, the latter 10 kilometers from the mouth of the Sebu. Both ports are closed by bars which permit only the passage of boats drawing three and a half meters. In each case a dredged channel will be protected by parallel jetties thrown out to sea. The case of Kenitra is especially instructive. This small port is a result purely of human determination. In 1912 it was nothing more than a *kasba*, or Moroccan citadel, lost on the desolate bank of the Sebu; it had not even a boat to suggest a port. But its situation and the even depth of the river attracted the attention of General Lyautey, and he conceived the plan of diverting to this point all the important commerce of the plain of Sebu and of Fez which, for lack of a natural outlet, had been directed northwards to the profit of the Spanish port of Larache.

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[2] See the plan in the appendix to La Revelière: Les énergies françaises au Maroc, Paris, 1917.

[3] Figures for 1916 from H. Dugard: Le Maroc de 1917, Paris, 1917, p. 171.

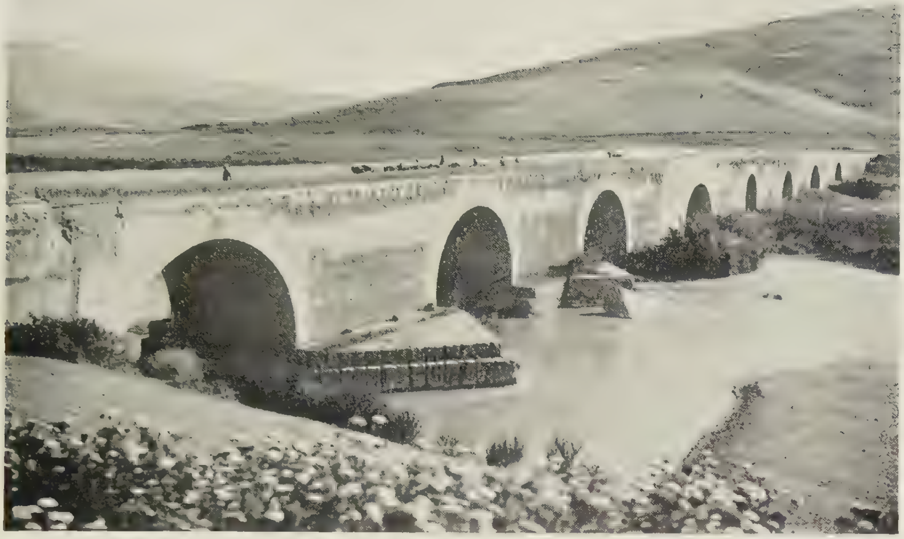

FIG. 8

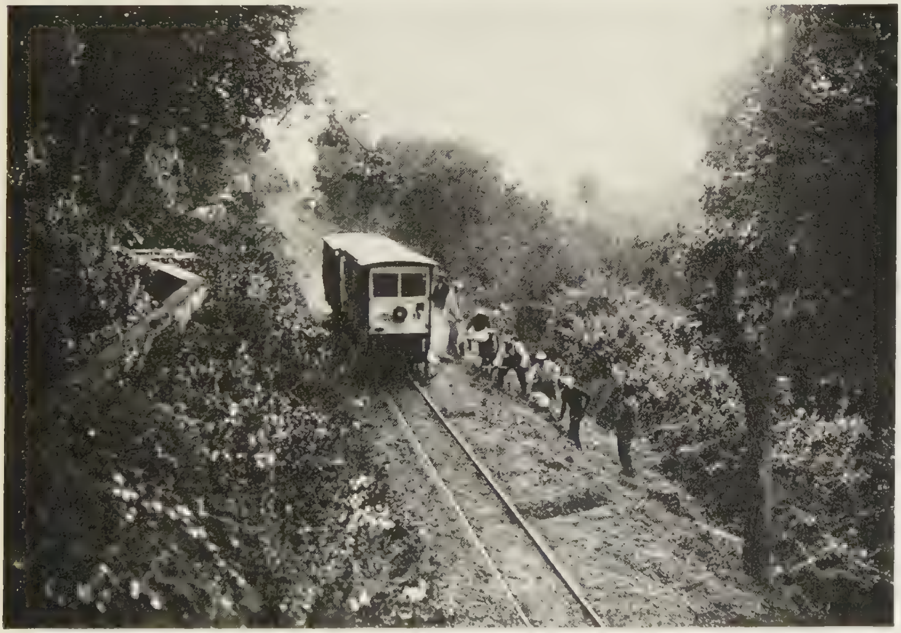

FIG. 9

FIG. 8—The Sebu near Fez, with one of the few bridges in Morocco. Difficulty of importing requisite material during the war has prevented bridge building from keeping pace with the notable progress in road building.

FIG. 9—A pioneer railway in Morocco. These narrow-gage lines (60-centimeter), primarily designed for military purposes, have been turned over to public service with much profit to commerce.

The works at the southern ports, Mazagan and Mogador, simply designed to furnish harbors for small sailing vessels, are practically completed. Farther south, however, pacification of the Sus has been too recent for the opening of a port at Agadir, though since 1917 the Department of Public Works has effected improvements for the better protection of the naval flotillas.

Five lighthouses of the first class have also been erected along the coast.

ROADS

In the matter of railroad construction France was not free to follow her own bent. German jealousy had insisted on the addition to the treaty of November 4, 1911, of a clause requiring the international Tangier-Fez railroad to take precedence over other lines in the French protectorate. The restriction on railways, however, gave special impetus to road building, and this, with the introduction of the automobile, has proved one of the chief factors in the rapid opening up of the country.

The highway program of 1913 included a road system aggregating 2,500 kilometers. At the beginning of the war only 50 kilometers of metaled roads had been constructed; today 1,600 kilometers are open to traffic, and another 600 kilometers will shortly be ready. During the war no work has been pushed forward more vigorously, for, conformably with General Lyautey's original plan, road building serves the double purpose of economic development and pacification. For the most part it is carried on with the help of native labor, which is thus afforded an additional source of livelihood.

Part of the system, however, has not yet been completed for lack of special material. This is the case with the large bridges. With the exception of a stone bridge across the Sebu near Fez and an iron bridge across the Um-er-Rbia, the rivers have been bridged by temporary structures. In addition a considerable amount of work has been done in improving the native roads where the situation has not permitted regular road building. This work, executed in general by the army, again serves the double purpose of military and economic ends. To the 1,600 kilometers of regular highways may thus be added 2,000 kilometers of roads practicable for wheeled traffic.

RAILROADS

Reference has already been made to the restriction on railroad development. This has been particularly annoying in view of the impediments encountered in the Tangier-Fez project, difficulties in the way of surveys and preliminary work and in the formation of a Franco-Spanish company. The first sections were not contracted for till 1917. Work on the line has now begun. Its total length will be 310 kilometers, of which 210 lie in the French zone.

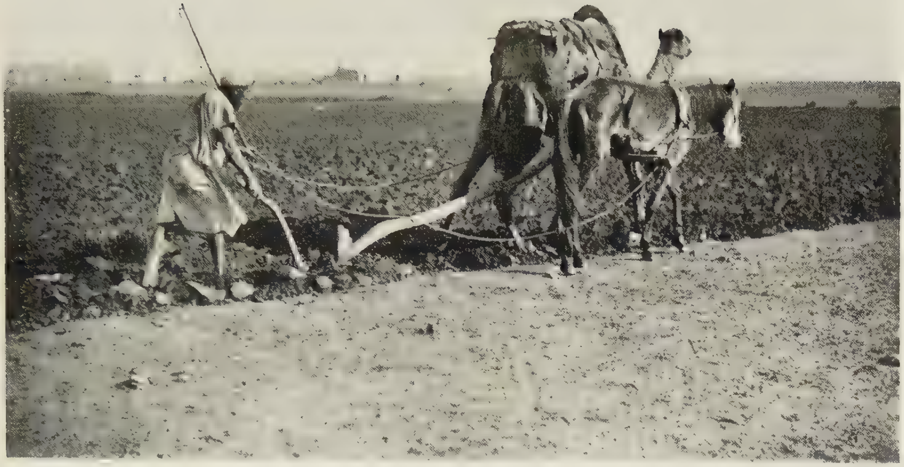

FIG. 10

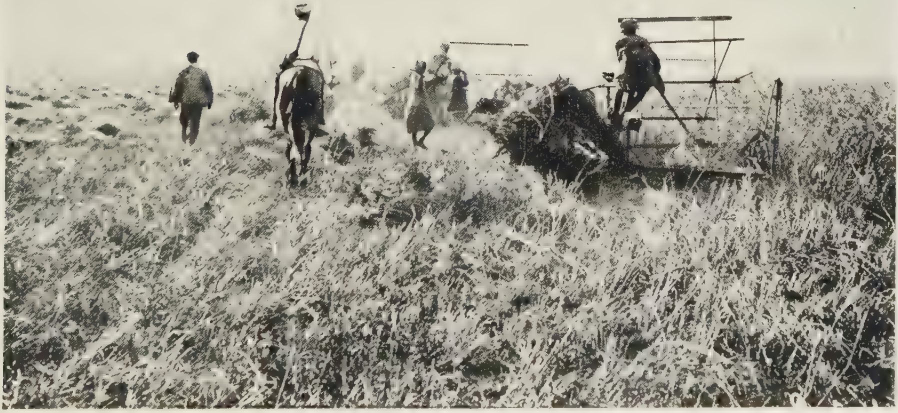

FIG. 11

FIGS. 10 AND 11—The old and the new in Moroccan agriculture. To the primitive plow are harnessed any available animals—and even women. "It is not unusual to see a camel, an ass, and a woman drawing the plow," says Bernard ("Le Maroc," 1913, p. 170). The introduction of modern agricultural machinery is, however, beginning to transform Moroccan agriculture.

A system of commercial lines for the protectorate has now been elaborated; agreement for construction and exploitation has been drawn up between the protectorate and two large French companies and simply awaits parliamentary sanction. The gage will be standard (1.44 meters), and the length will aggregate 870 kilometers. It will unite all the large towns—Fez, Meknes, Rabat, Casablanca, Marrakesh (see map, Fig. 1).

But, while awaiting the great lines of the future, Morocco has not been absolutely deprived of railroad facilities. It possesses a system of so-called Decauville lines (60-centimeter gage), a construction not interdicted by the treaty convention. The first lines of this type were started in September, 1912, and rapidly pushed forward, until today they aggregate 850 kilometers. At first reserved for military purposes, the lines have been opened to the public for passenger and freight traffic since March, 1916. The promptness of commerce to profit by the facilities thus offered, in spite of the inevitably high price of transport, is proof of the country's progress, as is suggested by the following figures, which exclude military transport. For the year 1917 and on the system in western Morocco only (622 kilometers), the receipts were 4,296,000 francs; the number of tons of merchandise transported, 43,500; the number of passengers carried, 205,000.

Will the utility of this narrow-gage system disappear with the construction of the main railroads? No; for the most part it can be used to supplement them, serving the same purpose as local lines in relation to trunk lines.

THE NEW TOWNS

The spontaneous birth and rapid growth of European towns in Morocco has placed before the protectorate a series of interesting problems that call for modern methods of solution.

The unrestrained tendency of the European town growing up beside the native town is to overshadow, to suffocate, and finally to replace its victim. To avoid this unfortunate sequence General Lyautey has laid down an absolute rule that the native and the European towns shall be separated, a plan adopted by the English in India. The policy is in accord with moral and hygienic principles. In an intimate mixture of two such dissimilar civilizations it is rather the vices than the virtues that flourish. On hygienic grounds the European should take up his residence away from those centers of infection, the Moroccan towns, with their narrow, dirty, ill-ventilated streets.

In the town plans of the future the first care will be to set aside a strip of ground separating the European and native sections, and on this strip all building will be prohibited. The work involved in such town planning is arduous and detailed; it calls for the imagination and taste of the artist, the science of the architect and the sanitary engineer. Its direction has been entrusted to a specialist, M. Prost, who lately drew up the plans for the extension of the city of Antwerp. The task, formidable enough when dealing with an entirely new town, is much more complicated in the case of a half-built town such as Casablanca, where construction proceeded in a haphazard manner at the hands of speculators in the first days of the protectorate. Established interests must also be taken into account. At present plans for the extension of the chief towns of Morocco—Casablanca, Rabat, Fez, Marrakesh,[4] Meknes—are practically ready, and some of them have already been announced. These prohibit all building within the limits of the future city that does not conform with the established plan.

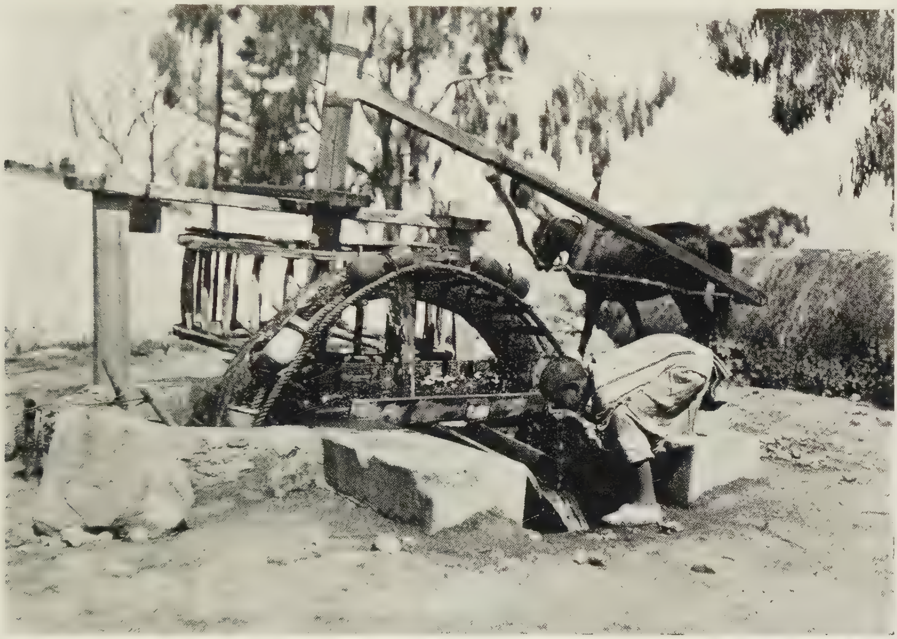

FIG. 12—The well, *noria*, of a Moroccan farm.

To enforce the execution of these plans special legislation has been necessary. A law of expropriation establishes the maximum value of the remaining lands for the calculation of indemnity. Another new measure—and a very advanced piece of legislation—provides for the formation of syndicated associations of proprietors. This permits the grouping of the neighboring proprietors of the same parcel of land for a redistribution of the land among themselves in a manner more conformable with the general interest. The experience gained in the preparation of these plans of extension and of the syndicated associations should furnish useful data for the reconstruction of the towns and villages in the devastated area of northern France.

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[4] For an account of the building of a European town, as exemplified at Marrakesh, see Georges Aimel: Le Guéliz-Marrakech: Naissance d'une cité au Maroc, *France-Maroc*, March, 1919, pp. 60-63.

AGRICULTURE

Morocco, like Algeria and Tunisia, of which it is the continuation, is above all a country of agriculture and stock raising. The Atlantic littoral, where the humid oceanic climate prevails, especially offers lands of remarkable productivity. It is difficult, however, to estimate the exact extent of these fertile lands. The total area of French Morocco is 42,000,000 hectares, but this includes vast desert stretches unavailable for cultivation, at least under present conditions. Such are the plain which extends to the south of Marrakesh, the plateaus of Tafilelt, and the dunes on the Algerian boundary. The extensive mountainous areas of the Middle Atlas and the High Atlas and the forest and marsh areas must also be deducted.

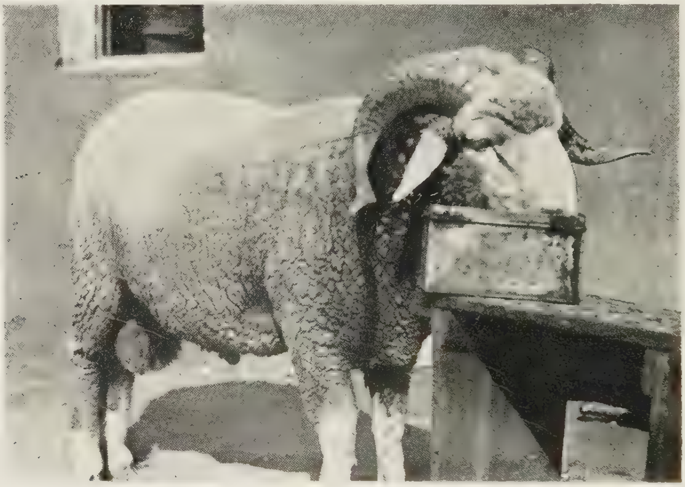

FIG. 13—A ram of Tadla, merino type. Sheep rearing in Morocco has a great future. The merino, appreciated for its fine wool and delicate meat, appears to have originated here.

The regions most favorable for cultivation are the plain of the Shawia around Casablanca, that of the Gharb to the north of Kenitra, the valley of the Sebu (plain of the Beni-Mtirs), the Dukkala south of Mazagan, the Abda about Safi—all these in western Morocco; in eastern Morocco are the plains of Trifa and Angad.[5]

In these plains, distributed in patches, occurs the famous *tirs*, an argillaceous black earth resembling the *chernoziom* of Russia. Unworkable during the rains, cracked and parched during the dry season, and demanding much labor, the *tirs*, rich in potash and nitrogen, is yet possessed of a marvelous fertility. It is especially adapted to cereal cultivation—wheat, barley, maize, and sorghum being the chief crops produced thereon.

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[5] On the zones in relation to climate see A. G. Ogilvie: Morocco and Its Future, *Geogr. Journ.*, Vol. 39, 1912, pp. 554-575.

The native Moroccan cultivates *in extenso,* tilling the lands easiest to work in a superficial fashion with the most primitive of appliances. The wooden plow that he uses only scratches the soil to a depth of six or seven centimeters. He never manures his land and knows nothing of the rotation of crops. Each year he chooses a new field, allowing last year's to remain fallow. The harvest is reaped by sickle or knife; animals tread out the grain from the chaff, which is winnowed by the wind.

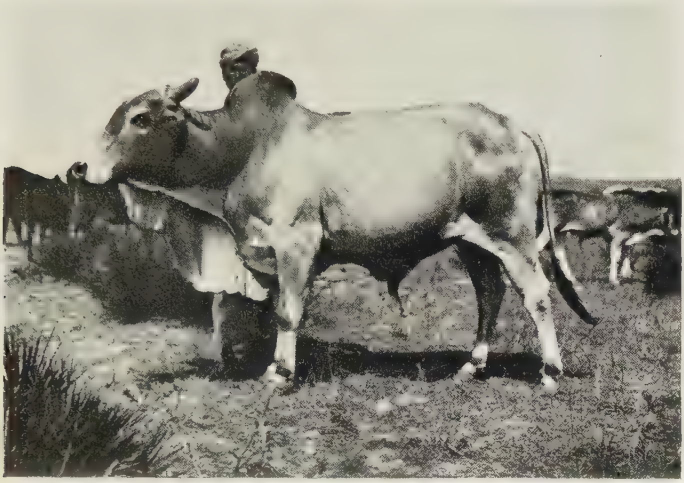

FIG. 14—An Indian zebu. The Indian zebu has been introduced into Morocco for crossing with native cattle, an experiment that has proved successful in Algeria, Tunisia, and Senegal. This is one of the ways in which the Agricultural Service created by the protectorate is endeavoring to effect improvement. Morocco has always been pre-eminently a pastoral country, but under indifferent handling most breeds of stock had deteriorated.

France seeks to bring about improvement of these primitive methods by education and supervision, all the while guarding against too abrupt a change of the ancient ways. Little by little the native adopts modern methods and equipment. A certain number of European colonists—there were only 200 before the war because of the difficulty of purchasing land and the uncertainty of title—scattered through the agricultural districts furnish examples of modern agriculture. Already agricultural machinery, including even motor tractors, is employed by some of the natives. The kaids of the Shawia, for example, have bought harvesting tractors for their properties.

To afford more direct assistance to the native the protectorate has established ''Sociétés Indigènes de Prévoyance,'' which, provided with a small capital, buy selected seeds to advance to the native cultivator. The plant species cultivated in Morocco are in general of very poor quality. Before the coming of the French all the wheat grown was of the hard variety unsuitable for making flour: the soft variety has now been introduced. In respect to other cereals and vegetables and fruit trees the Sociétés de Prévoyance have also replaced the existing kinds by better varieties yielding a larger return. Agricultural experiment stations are working along this line to determine the species best adapted to soil and climate and are also trying out results with a number of plants not yet acclimated in the country.

Similar methods are being employed for the regeneration of the animal species and for better practices in stock raising. Morocco is rich in cattle, asses, mules, horses, and especially in sheep, of which the flocks are estimated at 20,000,000 head. But no care is given to the stock; there is no shelter against inclement weather; provision of forage is unknown, although the flocks become greatly emaciated during the dry season and epizoötic disease is rife.

The French stock breeding service strives patiently against these bad conditions. It offers bounties for breeding; it has taken up the question of water supply and has sunk wells in the pastoral regions. Great help is given by the traveling veterinary inspectors, who visit the markets and *duars,* even going into the unpacified regions and gratuitously giving advice on the care of the stock.

Experimental farms, such as that of Fez, complete this work of agricultural education. Mention, however, should also be made of the steps taken to revive certain abandoned crops of much importance, such as the mulberry and cotton. Imported cotton goods have now replaced the native industry, and, with the exception of rare fields in the Sus, cotton cultivation has been abandoned. But there are hopes of resuscitating it. Experiments already made give promise for the future. Success will depend especially on irrigation facilities, an abundant labor supply, and cheap transportation; these conditions have not yet been realized in Morocco.

Colonization

In Algeria the government had adopted the *cantonnement* system, by which the tribes were relegated to territories judged sufficient, and the rest of the country was given over to colonization.

Such a measure would not be in accord with French policy in Morocco, with its respect of native rights. Beyond direct purchase of land from the natives, territorial opportunities for colonization are sufficiently limited. These include the lands of the Makhzan, that is the domain of the Sherifian Empire, not all of which are as yet available, though within the last year several important tracts have been opened for colonization. Outside of the domanial lands there are the collective lands of the tribes, of which, according to a recent law, portions unrequired may be alienated by the tribal assemblies. At present the chief obstacle to European ownership in Morocco comes from the traditional system of landed property. In the midst of the extreme complications arising from claims to the same piece of land, it has proved difficult, if not impossible, to verify the title of the would-be vendor. At the same time there has ensued interminable litigation, as there is in the Mohammedan law no provision for the extinction of titles.

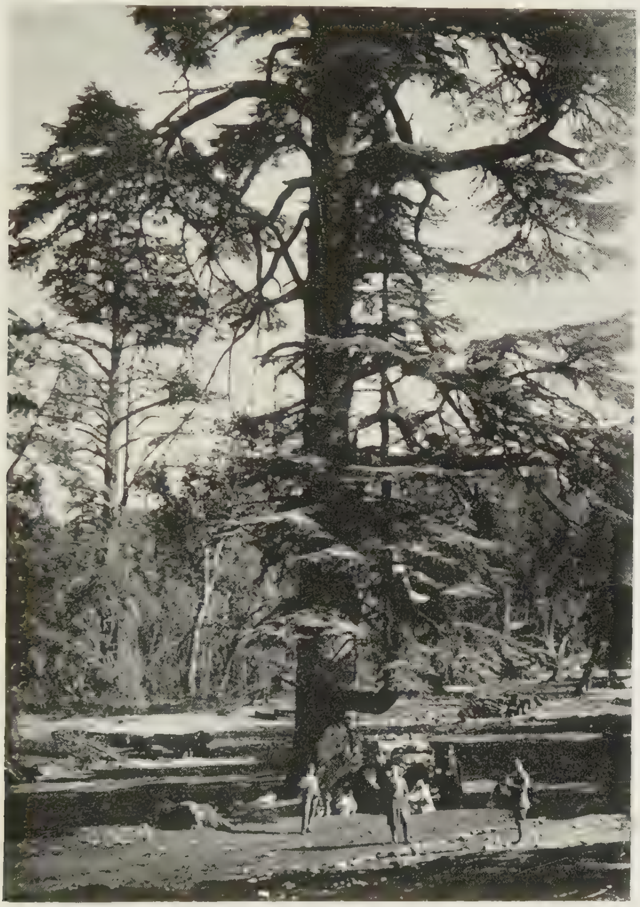

Fig. 15—The cedar, "sultan" of the Moroccan forest. Trees three to four hundred years old, 35 to 40 meters in height and 5 to 6 meters in girth, are not rare (Piquet: "Le Maroc," 1917, p. 58). The cedar forests cover great extents of the Middle Atlas at elevations between 1,100 and 2,300 meters.

Since 1913, however, there has been in force a law (*dahir*) instituting a new régime. All existing owners and all new purchasers of land can register their property, that is to say record it in the special land registers (*livres fonciers*). The administration then makes an examination of the property and a definition of its boundaries, operations accompanied by the widest publicity. If no protest is made during the six months following registration, the title of the property is assured. If any counterclaim is raised, the tribunal decides between the claimants, and only after decision does the title become valid. Inscription in the land registers annuls all former titles; this is the land statute of the new régime.

THE FORESTS

The forest resources of Morocco are very important. Three great zones may be distinguished. First there is the zone of the cork oak, which extends over an area of some 250,000 hectares, chiefly along the littoral. The most important forest of this type is the Mamora Forest, occupying 135,000 hectares to the north of Rabat. From the beginning the protectorate has taken measures to preserve these forests against the destructive operations of the natives, who do not use the cork but wastefully strip the tree to reach the underlying layer, from which tannin is extracted. The forest service has further opened ways of communication, dug trenches against fire, and built houses for the foresters. It has commenced a methodical exploitation of the Mamora Forest which, it is estimated, will furnish 100,000 quintals of cork a year.

The next zone, that of the cedar, is still more extensive; but this admirable tree, "sultan" of the Moroccan forest, is found only in the Middle Atlas at an elevation of over 1,300 meters. Not all the territory covered by this forest has been pacified, but the surface already known to be so covered surpasses 300,000 hectares, says M. Augustin Bernard.[6] The cedar forest, tall, green, and sunlit, with its unfamiliar beasts, its singing birds, its abundant waters well stocked with fish, is one of the most beautiful and interesting regions of Morocco. The tourist of the future will there enjoy some of the rarest pleasures that nature affords. These forests of the Atlas, many centuries old, were in great danger of perishing when France established her protectorate. The native woodsmen, for lack of proper implements, were in the habit of setting fire to the base of a tree to bring it down, and thus an entire section of the forest was often sacrificed. The forest service has taken the native woodcutters into its employ. A commencement has been made by disposing of the dead and fallen trees. The exploitation from this category alone has produced more than 3,000 planks (*madriers*) a month.

Lastly there is the zone of the *argan*, occupying over 200,000 hectares of the coast region south of Safi. The *argan*, peculiar to Morocco and the Canaries, appears to be the last vestige of a vanished tropical vegetation.[7] It is valued for its oil-yielding fruit, and its conservation in this arid region is likewise desirable from the point of view of the climatic advantages of a forest cover.

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[6] *France-Maroc*, December, 1917. See also Boudy: Les Forêts du Maroc, *ibid.*, May, 1919, pp. 113-119.

[7] L. Gentil: Le Maroc physique, Paris, 1912, p. 283.

MINERAL WEALTH

The Moroccan subsoil is still little known. Its reputation of richness in all kinds of mineral wealth came from the notorious Mannesmann brothers, who saw therein a means of drawing German interests to Morocco. In reality serious prospecting has scarcely been possible until the present time, and the mountain regions, where the presence of important deposits may most reasonably be expected, are not all open to free movement. The High Atlas still keeps its secrets; occasional travelers have noted the presence of lead, copper, and zinc; but no definite knowledge exists.

FIG. 16—Tabular cedars in a wood of holm oak, Middle Atlas.

The only positive information that we possess at present relates to the phosphate beds of El-Borudj, at the head of the Tafilelt, analogous to the famous deposits of Gafsa in Tunisia and the valuable Algerian deposits now on the point of exploitation; the manganese deposits of eastern Morocco, exploited during the war; the iron of Camp Boulhaut, near the coast between Casablanca and Rabat, still in the course of investigation; petroleum, of which there are many indications in northern Morocco and to the examination of which a special mission has been detailed. Bituminous schists, salt, gypsum, and slate also exist.

The mining law of Morocco has been in force since January, 1914. Persons of all nations have equal prospecting rights. Each discoverer, of whatever nationality, can be assured of the ownership of his discovery if he obtains from the administration a permit for search. A permit is good for three years and secures ownership over the area designated by payment of a tax. Before the war an international jurisdiction, the so-called "Arbitral Commission," including representatives of all the interested nations and presided over by a Norwegian magistrate, adjudicated the claims of discoverers. Unfortunately the commission had scarcely begun to operate when the war broke out; hence the disposition of certain claims still remains unsettled. A law recently passed will permit resumption of the work of this commission, with the safeguarding as far as possible of the rights of foreigners who cannot be informed.

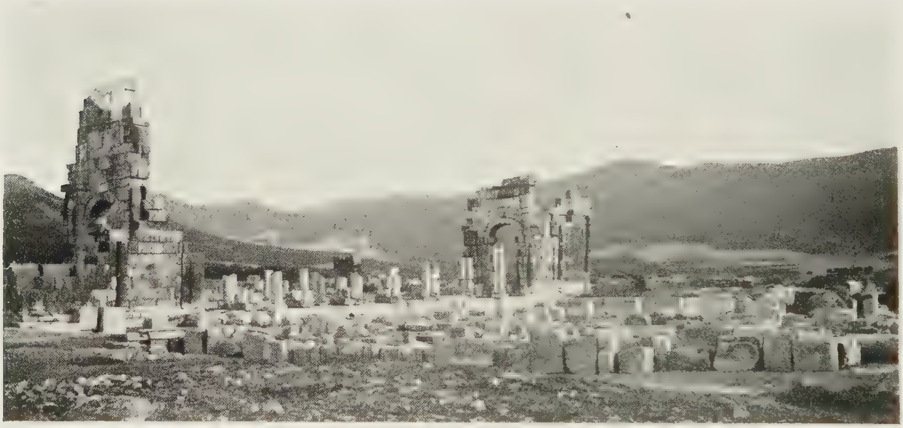

FIG. 17—The ruins of Volubilis. Fifteen centuries of "Barbary" have not yet effaced the traces of Roman occupation. Much of the material of Volubilis has been used in the building of Meknes, some distance to the south.

PUBLIC HEALTH AND MEDICAL ASSISTANCE

Hygienic and medical aid is the most certain and undoubtedly the most beneficial means of influencing the natives. Not only is it a humanitarian duty; the preservation and physical improvement of the race are also efficacious means of promoting French interests. Notably, the question of labor, vital in the development of new countries, is intimately related to the question of hygiene, especially of infant hygiene. As soon as a new post is established the army physician attached to the post opens a consulting room. He draws thither the native and thence exercises a supervision over the health of the region. As soon as means permit he adds to the consulting room a native infirmary more or less complete according to the importance of the post.

The posts are grouped by regions, and each region possesses its complete sanitary service for the natives, with separate buildings, operating and dressing rooms, kitchens, baths, etc. Some of these establishments have grown into regular modern hospitals, such as the Hôpital Mauchamps at Marrakesh and the Hôpital Cocard at Fez.

The primary element of this organization is the "mobile medical unit," a sort of perambulating dispensary, consisting of a physician, two attendants, and four guides with mules. This unit goes everywhere in the mountains, even among the unsubmissive tribes, to visit infected villages and suspected markets. It distributes quinine and gives consultations, dressings, and vaccinations. It is the genuine symbol of French work in Morocco. The work is strongly supported by the protectorate, which has lately introduced the automobile and the *camionnette* ambulance into these medical units.

To these organizations must be added the provisions for the health of Europeans—provisions especially important in the towns—in the form of dispensaries and consulting services and hospitals, most commonly connected with the army hospitals.

FIG. 18—The ruins of Shella, a "solitude of melancholy charm" (Tissot, *Bull. Soc. Géogr. de Paris*, Vol. 12, 1876, p. 273). Practically nothing remains of the Roman town (Sala Colonia). The present ruins are of the Shella that rose to magnificence in the late twelfth century under El Mansur and was restored and used as a necropolis by the Beni Marin Sultans, since when until very recently Mohammedan fanaticism forbade the place to Europeans.

Prophylactic measures are peculiarly urgent in Morocco, as in all Mohammedan countries, where lack of cleanliness and over-crowding occasion violent epidemics. Their organization and enforcement have been confided to the bureaus of health established in the towns. Particular care has been devoted to the organization of special therapeutic measures against syphilis, malaria, affections of the eye, and the gastro-enteric affections that work such havoc among children. To control syphilis, the curse of the Arab race, five great clinics have been established, and the most modern methods have been applied with a success that has brought them great renown among the natives.

EDUCATION

Formerly education in Morocco was of a purely religious character. In the primary schools it was sufficient for the pupils to learn to chant the Koran by heart. Even the highest education, that given at the Karuyin mosque of Fez, which still plays the rôle of university among the countries of Islam, was based entirely on theology; the sciences had no place, save astronomy; all studies bore directly on the interpretation of the sacred text. France has respected this religious teaching; she has only added to it. For primary instruction there are the Franco-Arabic schools, where the native youth of its own free will comes to learn French, the three R's, and some vocational subjects. The schools in no wise meddle with the religious traditions or customs of Mohammedanism, but they give the scholars some acquaintance with modern commercial methods and an understanding of the economic conditions in which French occupation of the country has placed them. The schools also give evening instruction to adults who wish to learn French. The instructions given to the new directorship of education by General Lyautey in 1913 called for the immediate opening of such schools in the *bled* wherever a sufficient number of pupils could be gathered together.

Today these Franco-Arabic schools, which, furthermore, are always well attended, number nearly a hundred. Some of them, such as the cabinet-making school of Salé and the accounting school of Fez, have almost assumed a professional character.

The secondary instruction established by the protectorate includes the Mohammedan colleges at Fez and Rabat, where the sons of the Moroccan bourgeoisie, previously prepared in special schools, are trained for positions in native administration. The courses of instruction, given in Arabic by professors who are French for the most part, deal with Arabic grammar and literature, the history and geography of Morocco and France, arithmetic, and the usual scientific subjects.

Crowning this organization is the "École Supérieure de Langue Arabe et de Dialectes Berbères" at Rabat, which has become a center of linguistic studies and the training school of European and native administrators.

The advanced instruction given in the Karuyin mosque has not been touched save for an administrative reorganization, which has created a council of professors (*ulemas*), and the furnishing of material resources that were previously lacking.

Quite distinct from the Mohammedan schools are the Jewish schools which had been organized before French occupation by the remarkable efforts of the Universal Hebrew Alliance. These schools, at present thirty-five in number, give instruction in the ordinary subjects and in the French language, a circumstance that has greatly assisted the propagation of French influence.

Europeans also find in Morocco the various grades of primary and secondary instruction that obtain in France: primary schools in the towns, an upper primary at Casablanca, secondary schools for boys at Casablanca and Rabat, and a secondary school for girls at Casablanca.

Art in Morocco

The liberal spirit of a protectorate is nowhere better attested than in its attitude toward the native arts. Its works of art reveal the truly original character of a race: by its esthetic creation it manifests its vitality.

The Moroccan terrain is strewn with ancient ruins. There are such vestiges of Roman domination as the scattered stones near Meknes that mark the site of Trajan's city of Volubilis. The work of excavation and of recovery of inscriptions was deemed by General Lyautey a labor not unworthy of soldiers, even in war time; and on this task German prisoners especially were employed.

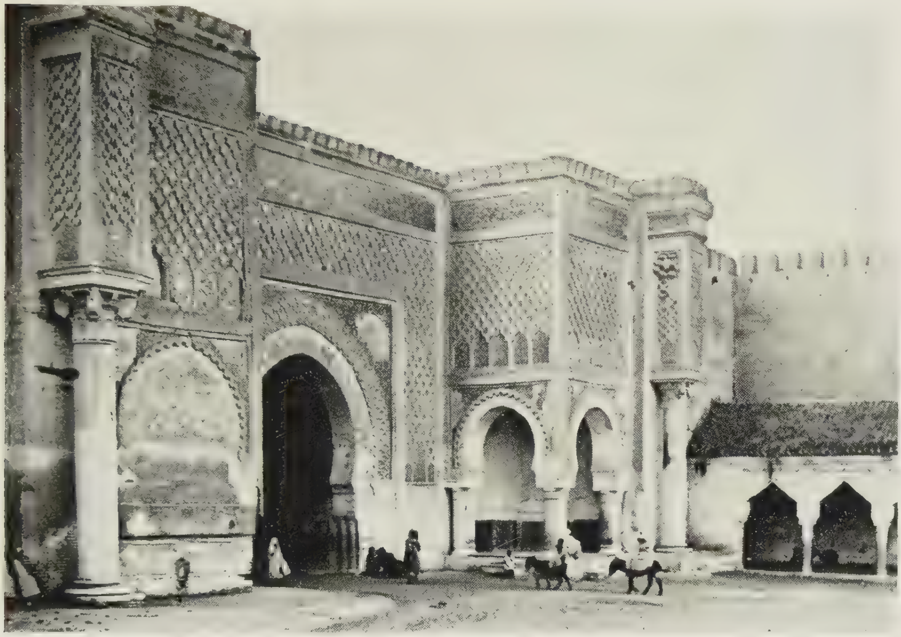

Fig. 19—Bab-el-Mansur, the gate of Mansur, is one of the most imposing monuments of Meknes. The ornamentation is in brilliant faience; the marble columns are of material probably brought from Volubilis.

Moroccan art proper begins with the dynasty of the Almohades in the second half of the twelfth century. Monuments of their rich but restrained art survive in the three slender carved towers, the admiration of all artists—the tower of Hassan at Rabat, the Kutubiya at Marrakesh, and the Giralda of Seville. Under the Merinides (Beni Marin) Moroccan art attained its apogee. Their style, richer and more elegant than the art of their predecessors, is preserved in the incomparable monuments of the *medersas*, or colleges of the students, of Fez. In the *medersas* a supreme artistic effort has been realized in the resplendent interiors, where are found united all the resources of the minor arts of ornamentation, of

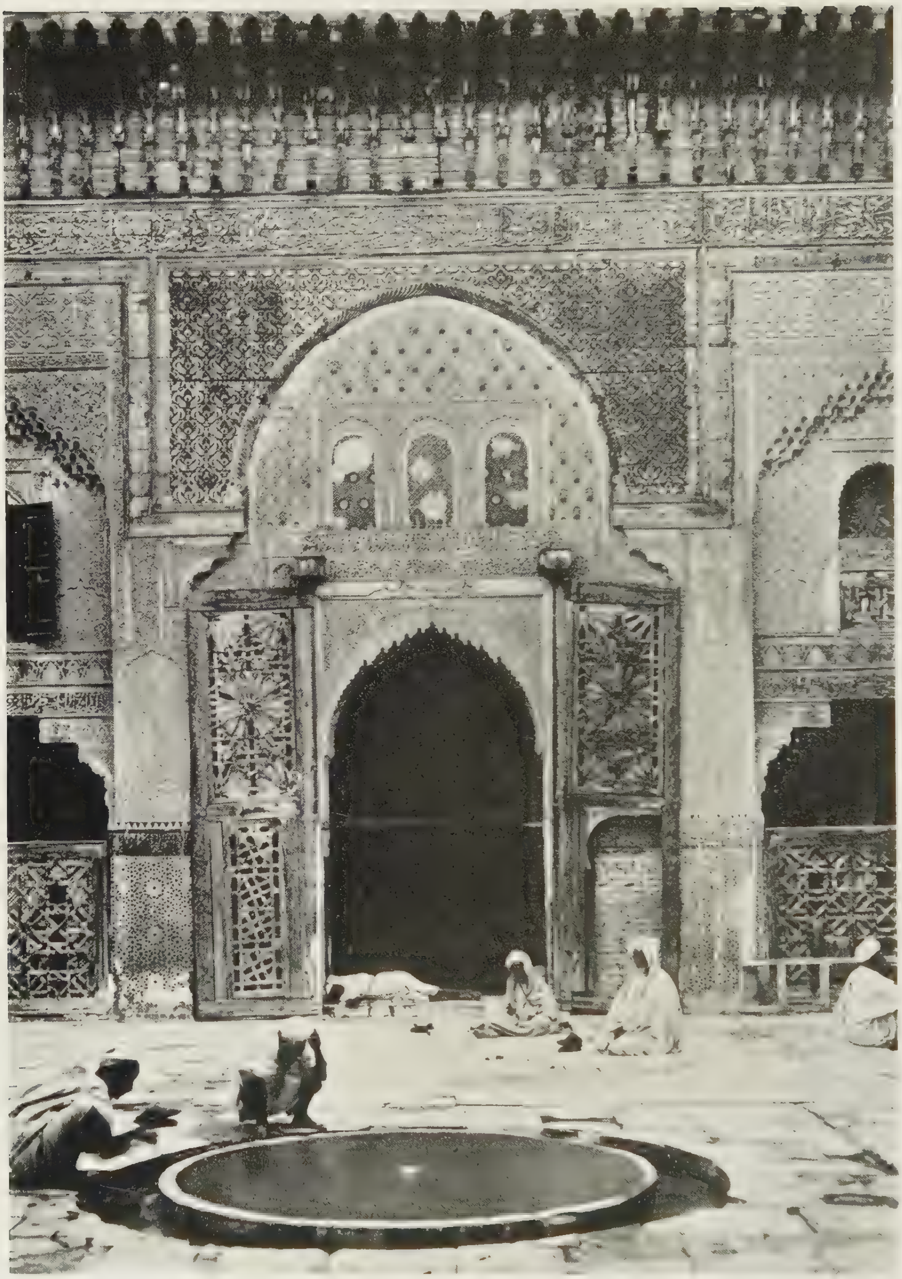

FIG. 20—Court of the *medersa* (college of students) Buananiya at Fez, an eloquent expression of the Moorish art of ornamentation

mosaic, and of stucco. These monuments, previously unknown to students of art, were discovered five years ago in a discouragingly ruinous condition; the *zelliges*, or mosaics, of the Middle Ages were half gone; the stuccos and wood inlays were crumbling to dust.

The first care was to see whether there still existed in Fez any artisans who preserved the old traditions. Happily such were found. France took them into her service, putting them under the direction of authorities well acquainted with the beautiful models of Arab art. She also assured them pupils and charged them with reviving traditions fast being forgotten; thus she has been able to restore monuments of an art which by reason of Arab indolence would have perished in another fifty years.

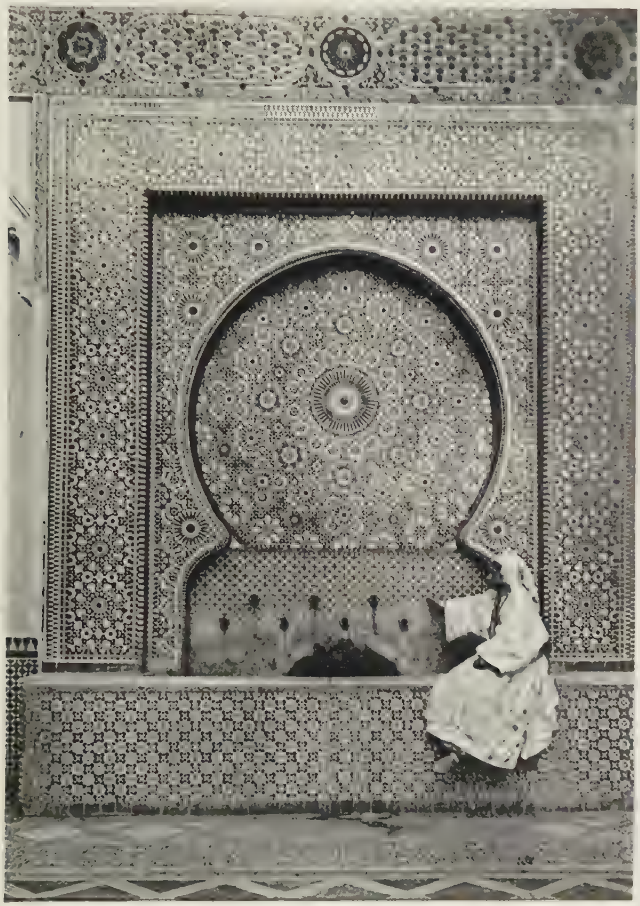

FIG. 21—A fountain in Fez.

These monuments, these artistic traditions still revealed in the mosques, the palace, and private dwellings give the towns of Morocco, particularly Fez and Marrakesh, a special attraction for the tourist. There, among these medieval crafts, customs, and political organizations, one is transported back to the Middle Ages. Morocco is one of the few countries of the world which has not been touched by modern civilization until recent years.

Besides the artistic beauty of the towns and the picturesqueness of the extraordinarily intense life circulating in their narrow, crooked streets, Morocco possesses the potent attraction of the *bled* and of the desert with its far horizon, the luxuriant palm groves, the beautiful gardens of Marrakesh and Sefru, and not least the great cedar forests of the Atlas. These forests General Lyautey has decided to set apart as a national park, after the fashion of the United States.

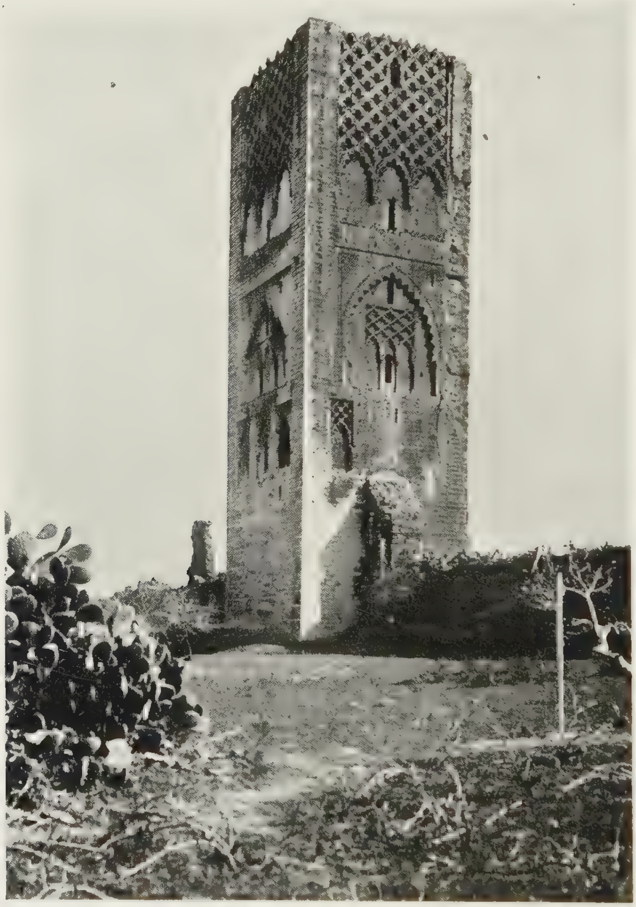

FIG. 22—The tower of Hassan outside Rabat. Town and tower were built by the Sultan El Mansur. The tower, 45 meters high, beautifully ornamented with fretted stone work, is sister to the towers of Giralda at Seville and Kutubiya at Marrakesh. They survive as admirable examples of early Moorish art.

SUMMARY AND CONCLUSION

The rapid development of French Morocco in spite of the war is shown by the annual statistics. The figures for the combined import and export movement are:

1911	139,698,000	francs
1912	177,737,000	"
1913	221,607,000	"
1914	163,999,000	"
1915	235,940,000	"
1916	310,854,000	"

A faithful mirror of prosperity is seen in the finances of the country. The Moroccan budget shows a growth unique in French colonial history.

	Expenditure		*Receipts*	
1913-1914	21,663,000	francs	15,925,000	francs
1914-1915	29,255,000	"	21,776,000	"
1915-1916	38,925,000	"	46,086,000	"
1916-1917	32,153,000	"	58,485,000	"

How can this growth be explained? The writer does not hesitate to say that it is because France has entrusted the country to a man of courage and vision. Timidity and economic parsimony have hindered her colonial policy in the past. To his office General Lyautey has brought something of the spirit of the Roman proconsuls who, looking to the future, built with celerity an enduring edifice.

To start Morocco on its future career General Lyautey has provided a port adequate for the maximum demands, roads and railways equal to the requirements of a large traffic, plans for extension of the great cities to be executed as need arises. To save the country during the crisis of the war he has not hesitated to engage the funds of the Moroccan loan and to multiply the public works, schools, hospitals, administrative and military buildings. And in the midst of the war he has ventured commercial undertakings, expositions, and fairs whose example has been followed by Paris and Lyons.

Such lavish expenditure is in reality economic wisdom. The millions of the Moroccan loan expended to save the country during the war are all to the advantage of its future development. Is it not a profitable sacrifice that results in the sparing of immense resources, the conservation of valuable properties for which France is responsible? General Lyautey's policy, furthermore, has enabled Morocco to make direct contribution to the national defense of over 30,000 native soldiers and several million tons of wheat, maize, and sorghum, without counting wool, hides, and skins.

Yet, however bold and optimistic this method, it would be open to failure if not based on a deep and essential liberalism. The secret of French influence in Morocco and of France's policy with the natives lies in the constant effort to approach the native spirit, in scrupulous regard for the native beliefs, manners, and customs. The sincerest homage to France's liberalism is rendered by the people of Morocco themselves, who, once having accepted her tutelage, have no desire to withdraw from it but continue to accept of their own free will the intervention of which they were formerly defiant. Once won over to peace and put in the way of profitable trade, they have no desire to return to their former warlike and poverty-stricken life.

This implies that respect for native tradition does not exclude introduction of changes necessary to put this people in the way of modern life. To introduce new methods appeal must be made for co-operation on the part of the natives. In whatever is done in the way of agricultural development, colonization, public work of any sort the native must be associated with the government to mutual advantage. Such collaboration, the final goal of French policy in the protectorate, is likewise the object of certain recent reforms in Algeria.

The conception was nobly expressed by General Lyautey on a recent occasion, the obsequies of Colonel Berriau, one of the chief builders of this policy:

> He was not one who looked back: his gaze, prudent and wise, was on the future. This country, whereon we have so prodigally lavished our blood and our gold, was to him no field of exploitation, no reservoir of resources to be merely tapped for our benefit. In his regard this people, who have given such proofs of loyalty and of devotion, who bring such qualities of intelligence and service, have an unalienable right to participation in all its benefits. And this, the doctrine of the protectorate, is the political and social doctrine of the highest morality—the rights of all peoples, of which today we are the standard bearer for the world.

CZECHO-SLOVAKIA AND ITS PEOPLE*

By MILIVOY S. STANOYEVICH

The aspirations of the Czecho-Slovaks to be regarded as a distinct people, with national traditions and ideals peculiar to themselves, have been formally acknowledged by most European states. Their claims are incontestable and are only disputed by those who fail to distinguish between what is meant by self-determination and the question whether or not a nation is fitted to take charge of its own destinies. Few people in Europe have proved more resistant to efforts toward assimilation than the Czechs and the Slovaks, who have suffered the double disadvantage of forming part of a corrupt and stagnant empire. They have been cut off during the past three hundred years from all contact with Western Europe and have lived in a constant state of instability and insecurity on the very fringe of that empire, which, though strong enough to encompass them, was not strong enough to subdue them. After the centuries of sufferings under foreign domination, the race which gave birth to Huss, Comenius, Kollár, and Palacky, and which has justly earned a reputation for courage, industry, and integrity, has come into its own.

UNITY OF THE CZECHS AND THE SLOVAKS

The Czecho-Slovaks, or Čecho-Slováci,[1] as they are proud to call themselves, live in a compact mass in Bohemia, Moravia, Silesia, and Slovakia, from the Böhmerwald on the west to the Danubian city of Pressburg on the south and to the upper Tisza on the east (see map, Fig. 1). There are about 12,000,000 of these people altogether. This extensive region, about the size of the state of Pennsylvania, is, as a whole, mountainous, except for the Danube plain, and is richly endowed with forest. This forested mountain land offered to the Western Slavs a natural refuge against the invading hordes of Magyar, Mongol, or Turk, which, throughout the centuries, swept across the great, open Hungarian plain of the Alföld only to be halted by this obstacle in their onward sweep.

Under pressure of invasions from without, the Slovaks of northern Hungary and the Czechs of the Bohemian plateau were thrown together

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*In the present article and on the accompanying map (Fig. 1) names are spelled in the Czech form. As to pronunciation: with the exceptions noted, vowels are pronounced as in Italian and consonants in general as in English. The exceptions relate mainly to letters distinguished by diacritical marks. These are: ě=ye, ů=oo; j=y, ň=ny (Spanish ñ), c=ts, č=ch, š=sh, ž=zh (French j), ř=rsh, ch=kh (German and Scotch gutteral ch).—EDIT. NOTE.

[1] In English the name Czech (pronounced Chek) is generally written in this, its Polish form (in Bohemian, Čech). It is probably derived from the name of the first leader of the Bohemian people. Now this name signifies an inhabitant of Čechy, the native designation of Bohemia, the Boian land. The Slovaks (Boh. Slovák, plur. Slováci, originally meaning Slav) speak practically the same language, i. e. a dialect of the Czech, as the Walloon of Belgium is a dialect of French. (See Louis Leger: La liquidation de l'Autriche-Hongrie, Paris, 1915, p. 26).

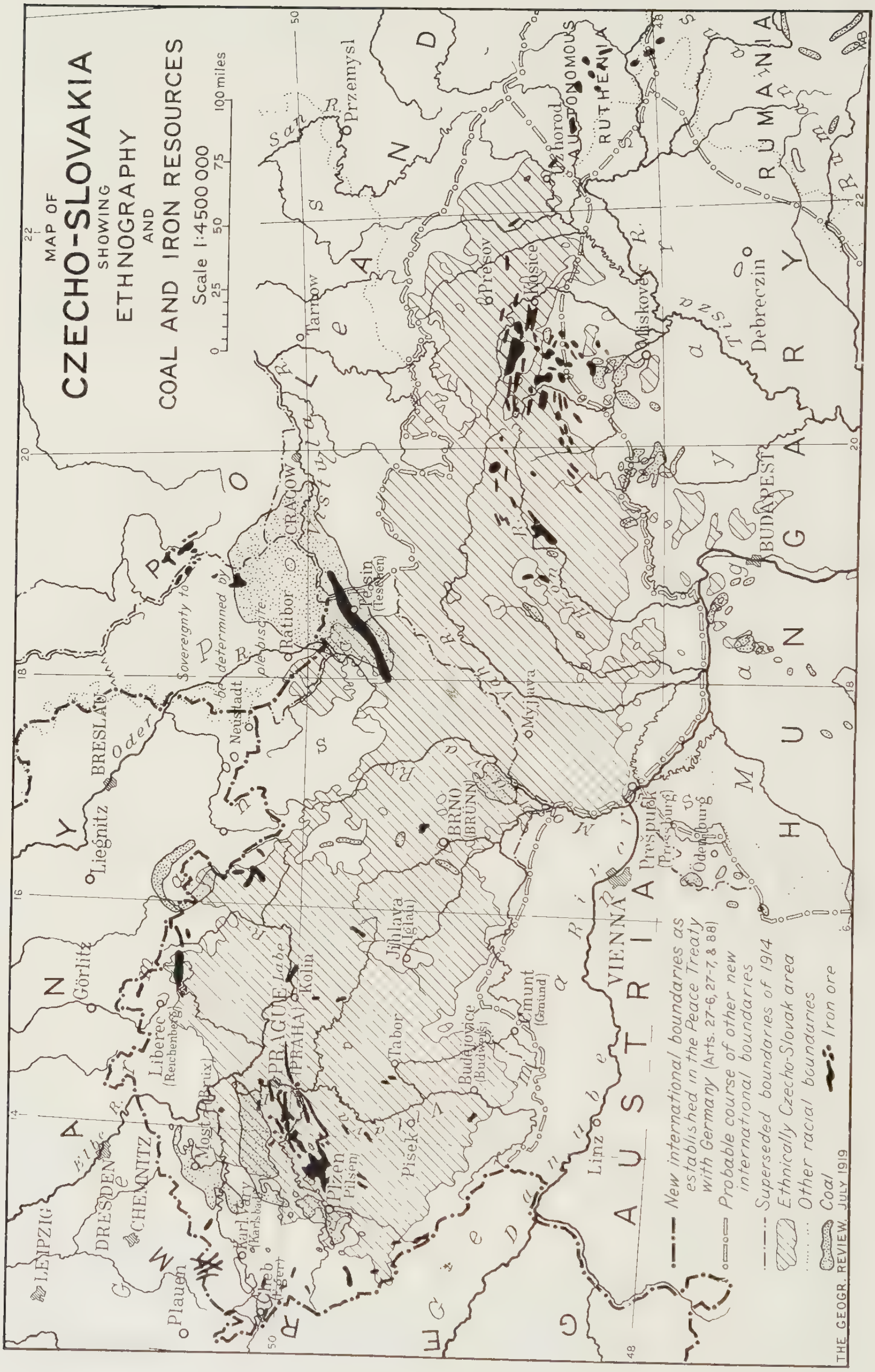
MAP OF
CZECHO-SLOVAKIA
SHOWING
ETHNOGRAPHY
AND
COAL AND IRON RESOURCES
Scale 1:4500000
0 25 50 75 100 miles
New international boundaries as established in the Peace Treaty with Germany (Arts. 27-6, 27-7, & 88)
Probable course of other new international boundaries
Superseded boundaries of 1914
Ethnically Czecho-Slovak area
Other racial boundaries
Coal
Iron ore
THE GEOGR. REVIEW, JULY 1919
GERMANY
POLAND
AUTONOMOUS RUTHENIA
RUMANIA
HUNGARY
AUSTRIA
Sovereignty to be determined by plebiscite
LEIPZIG
DRESDEN
CHEMNITZ
Plauen
Görlitz
Liegnitz
BRESLAU
Oder
Neustadt
Ratibor
CRACOW
Vistula R.
Tarnow
Przemysl
San R.
Těšín (Teschen)
Cheb (Eger)
Karl. Vary (Karlsbad)
Most (Brux)
Liberec (Reichenberg)
Elbe R.
Labe
PRAGUE (PRAHA)
Kolin
Plzen (Pilsen)
Pisek
Tabor
Jihlava (Iglau)
BRNO (BRÜNN)
Budějovice (Budweis)
Gmünd (Gmünd)
Linz
Danube R.
VIENNA
Prešpurk (Pressburg)
Ödenburg
Myjava
BUDAPEST
Miskovec
Košice
Prešov
Uzhorod
Debreczin
Tisa R.
Hron R.
Váh R.
Morava R.
50
48
14
16
18
20
22

Fig. 1

and shared a mutual life, especially since the rolling Moravian country constituted no barrier. They had the same language, the same interests, the same enemies, and the same religion. In fact the only obstacle to their unification was the policy carried out by the Austro-Hungarian monarchy. But to understand better the claims of the Czecho-Slovaks, the elements of their history should be briefly reviewed.

History of Bohemia

After the rise of the Holy Roman Empire, which, in the name of the Roman Catholic Church, Germanized the Slavs of Central Europe, Bohemia succeeded in maintaining her national integrity and Slav character under the rule of her native princes. In the eleventh century the independence of Bohemia as a kingdom was recognized by the Roman emperors, and the kings of Bohemia became electors of the Holy Roman Empire. In the thirteenth century the Bohemian King Přemysl II began aggressive warfare against Rudolf Hapsburg, which ended in his own defeat.[2] Rudolf's position was thus strengthened to such an extent that he became emperor of the Holy Roman Empire and laid the foundations of the Austrian Empire. During the fourteenth century there arose a movement in Bohemia against the luxury and demoralizing influence of the Catholic Church and of the emperor personally—a movement directed toward a purification of life and morals. John Huss, head of the University of Prague and a disciple of John Wiclif, became the exponent of this new doctrine, which opposed the authority of Rome. This movement was in reality the germ of the Reformation. The burning of Huss and his friend Jerome of Prague by the Council of Constance, with the silent consent of the Emperor Sigismund, was the cause of the Hussite wars, those implacable struggles of the Czech nation against the Holy Roman Empire and the Latin Church.[3] The battle of the White Mountain (Bilá Hora) in 1620 wiped out the Bohemians as a nation and almost exterminated them as a people. The Hussites also disappeared as a political power but continued to exist as the Bohemian Brethren. Later they were included in the more general name of "Protestants" borne by the adherents of the Reformation.

The religious wars had weakened Bohemia to such an extent that she was obliged to recognize the Hapsburgs as her rulers. The despotic rule of the Austrian emperors led to many rebellions and revolutions in the seventeenth and eighteenth centuries, but they were always suppressed by terrorism and persecution. In such acts of oppression the Hapsburgs were assisted by the Jesuits, who took revenge on the "heretic" Czech nation by burning hundreds of thousands of Bibles and religious works written in the vernacular. It seemed at one time as if both the nation and its language were destined to be exterminated under the Germanizing system of the foreign rulers.

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[2] See Ottův: Slovnik Naučný, Vol. 6, p. 215, 1893.

[3] The Hussite wars lasted for many years. When they were finally brought to an end, the Czechs found that they had lost 2,200,000 men. (Cf. "Czechia i Czechi," *Russkaya Resyeda*, 1896, January, p. 107; cf. also E. Denis: Huss et la Guerre des Hussites, Paris, 1878.)

THE CZECH RENAISSANCE

But in the beginning of the nineteenth century there came about an entirely opposite result, namely the revival of the national consciousness of the Czech nation. It was due partly to the humanitarian revolutionary movement that spread from France over all Europe and partly to the efforts of a few Czech and Slovak patriots to revive the almost forgotten Czech language and literature. Jan Kollár (1793-1852), a scholar and poet, was the first to seek to inculcate in the Slavs the sentiment of Pan-Slavism. He compared the Slavonic culture to dawn; the German culture, to day; the English, to midday; the French, to afternoon; and the Spanish, to night.[4] His collection of poems "Daughter of the Slavs" (Slávy Dcera) inspired the Slavonic race with great hope and confidence. It is regarded as the gospel of Pan-Slavism. Another Slovak who played a great rôle in the revival of Bohemia was Paul Josef Šafařík (1795-1861), author of "Slavic Antiquities" (Starožitnosti Slovanské), "Slavic Ethnography" (Slovanský Národopis), and numerous philological works. The third member of the triumvirate of the Bohemian renaissance is František Palacký (1798-1876), author of "The History of the Bohemian People" (Dějini Narodu Českeho), a work based on wide research into original sources. He is the greatest of the Bohemian historians, and the Czechs call him "Otec Naroda" (Father of the People).

THE CONTINUED STRUGGLE AGAINST AUSTRIA

The iron despotism of Metternich and the Hapsburgs utterly failed to stop the revival of Bohemian literary, social, and political life. The new generations, with L. Stúr, K. Havliček, Svatopluk Čech, Jaroslav Vrchlický, Masaryk, and Kramař as their leaders, continued the struggle of their predecessors against the Hapsburg rule, or rather misrule. To reconcile Bohemia with Austria was the work of a Sisyphus. The Czecho-Slovaks were deceived by the Austrian statesmen not once but many times. They have often been imposed upon by the emperor himself. That is the reason why they never gave up the struggle all through the reign of Francis Joseph. But it is necessary to add that throughout the war they still persisted in supporting their juridical case. It was in view of this case that the Reichsrat was convoked on May 30, 1917, for the first time during the course of the war. On that occasion the Czech deputies solemnly proclaimed the independence of their country. It is by virtue of this juridical case that similar proclamations have been made since that time, at every sitting of the Reichsrat. The united Czech parties declared before the entire world that they accepted this program. The most resounding acclamation of these ideas took place in Prague, when the Czech deputies of the Reichsrat and the Diets, finding themselves in accord with the Slovaks of Hungary, came together on January 6, 1918, in a Czech constituency and voted a declaration to this effect. Such a declaration had been violently suppressed by the Austro-Hungarian government. The Austrian government, however, was not able to put down the determination to act expressed by those Czecho-Slovaks who remained outside the Hapsburg monarchy.

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[4] That is, the past of Europe belonged to the Latins, the present belongs to the Anglo-Saxons, and the future will belong to the Slavs.

The Recent Declaration of Independence

On October 18, 1918, the Bohemian National Council, recognized by the Allied and American Governments as the Provisional Government of the Czecho-Slovak state, issued a new declaration of independence signed by Professor T. G. Masaryk, as Prime Minister and Minister of Finance, General M. Stefanik, Minister of National Defense, and Dr. E. Beneš, Minister of Foreign Affairs and the Interior. This declaration was issued simultaneously in Paris, London, Rome, and other European capitals, and in New York.[5] Its significance consists in the fact that it influenced the other Slavs, especially the Yugo-Slavs, to resist the Austro-Hungarian Empire and to accelerate its dissolution. The acceptance of the terms of the armistice, as framed by the Allies, meant the fall and the dismemberment of the Dual Monarchy. What the future will be of this former mighty empire, which is now a small mid-European state, will depend largely upon the effectiveness of the League of Nations.

Future Prospects as Based on Economic Resources

As to the Czecho-Slovak republic, its future will depend on the skill with which its boundaries are drawn. Expediency, and not strict justice, has always ruled the decisions of the Great Powers, who are the final court of appeal in such matters. But if a mistaken idea of what seems to be the easiest way is allowed to prevail, and if the land greed of the neighboring states is permitted to supplant the claims of natural and ethnical frontiers, then the Central European question, far from being settled, will only be directed from Scylla toward Charybdis.

Provided Czecho-Slovakia is assured the possession of the geographical and ethnographical frontiers that are her due, she has no reason to despair of a prosperous and even brilliant future. The Czecho-Slovak has many of the sterling qualities that make for success. He has known how to utilize the resources with which nature has lavishly endowed his country. Agriculture is highly developed. Oats, rye, barley, wheat are the chief grain crops. The potato, which forms the staple food of the people, is extensively grown. The cultivation of the sugar beet has become of great importance. Flax and hemp are also grown; also fruit, especially plums, which constitute an article of export. Although not so well developed as agriculture, the rearing of sheep, horses, and cattle and poultry and bee farming are also extensively carried on. The unusually rich coal and iron resources of Bohemia (see map, Fig. 1) and its water power point to a high degree of industrial development. Indeed, the country in the last half of the nineteenth century has become one of the greatest manufacturing centers of Europe. The glass industry, introduced from Venice in the thirteenth century, is of great importance. The manufacture of porcelain is extensively carried on. The textile industry also stands in the front rank. Silver and leather work have a long history as local industries. Such industries exhibit the Czechs' delicate artistic sense and are capable of considerable development.

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[5] For the complete text of the document in English see the *New York Times* of October 19, 1918.

THE DIFFICULTIES TO BE FACED

If there are any grounds for pessimism at all, they lie in the departments of administration and finance. Much money will have to be expended before the economic resources of the country can be properly made available. The opening of communications and the construction of roads and waterways will absorb large sums at the outset, to say nothing of the cost of setting up and maintaining the ordinary machinery of government, of schools, hospitals, and other institutions.[6] The reform of the system of land tenure, which entails the breaking up of huge feudal estates, is an absolutely necessary political measure which should be undertaken before the country can look forward to any agricultural progress.[7] The government, of course, will have no easy task in overcoming local prejudice against changes and in combating the power of vested interests. Taxation, too, is another difficult and intricate problem for the administration to solve. However, hope lies on the one hand in the patriotism of the people, particularly in that of the richer manufacturers and local leaders, and on the other hand in the fact that, whereas every other state in Europe resumes its normal life after the war burdened with an unprecedented debt, Czecho-Slovakia starts clear of liabilities excepting those which she voluntarily incurs for the development of her resources. If Europe is in earnest in her intention to create this new republic and is careful to go about the undertaking in a spirit of frank and painstaking justice, she may rest assured she will not be disappointed with the result of her labor.

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[6] In Czecho-Slovakia there are now about 6,000 elementary schools, 110 secondary schools and junior colleges, 65 agricultural schools, 39 commercial and industrial schools, 2 polytechnic institutes, and 1 university. (Cf. E. Beneš: La place des Tchècoslovaques parmi les Slaves, *Scientia*, Vol. 23, 1918, p. 55.)

[7] Recently it has been announced that the National Assembly has already ordered expropriation of all estates in Czecho-Slovakia of more than 375 acres under cultivation and 250 of woodland. Under this law the state will take altogether 3,250,000 acres of cultivated land and 7,500,000 of woodland, sufficient, according to estimates, for maintaining 430,000 families.

ST. BRENDAN'S EXPLORATIONS AND ISLANDS

By W. H. BABCOCK

[With separate map, Pl. I, facing p. 40.]

THE LISMORE VERSION OF THE SAINT'S ADVENTURES

The fifteenth-century Book of Lismore, compiled from much older materials, tells us that St. Brenainn (evidently St. Brendan, the navigator)—

> desired to leave his land and his country, his parents and his fatherland, and he urgently besought the Lord to give him a land secret, hidden, secure, delightful, separated from men. Now after he had slept on that night, he heard the voice of the angel from heaven, who said to him, "Arise, O Brenainn," saith he, "for God hath given thee what thou soughtest, even the Land of Promise." . . . and he goes alone to Sliab Daidche and he saw the mighty intolerable ocean on every side, and then he beheld the beautiful noble island, with trains of angels (rising) from it.[1]

Thus far, in the rather redundant style of such literature, from the Life of Brenainn in the Lives of the Saints of this old manuscript. After a century and a half of disappearance this manuscript was accidentally discovered in 1814, in a walled-up recess, by workmen engaged on repairs.

Mr. Westropp holds[2] that this Lismore version is the "simplest and probably the earliest"; but its full-blown development of certain marvels (such as the spending of every Easter for at least five years on the back of a vast sea monster as a substitute for an island) may well awaken a question as to the validity of this conjecture.

However, the suggestion of the voyage by a dream seems likely enough, and his mood was in keeping with the anchorite enthusiasm of his time. Of course he promptly set forth to find his "promised land"; at first, in a hide-covered craft, with failure in spite of long endeavor; afterward, by advice of a holy woman, in a large wooden vessel, built in Connaught and manned by sixty religious men, with final success.

ANOTHER VERSION

Another version gives the credit of the first incitement to a purely human visitor, a friendly abbot, St. Brendan's aim being to reach an island "just under Mount Atlas." Here a holy predecessor, Mernoc by name, long vanished from among men, was believed to have hidden himself in "the first home of Adam and Eve." To all readers this was a fairly precise location for the earthly paradise. The great Atlas chain forms a conspicuous feature of medieval maps, running down to sea (as it does in reality) near Lanzarote and Fuerteventura, the innermost of the Canaries, which seem like detached, nearly submerged, summits of the range.

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[1] Anecdota Exoniensia: Lives of the Saints, from the Book of Lismore. Edited, with a translation, notes, and indices, by Whitley Stokes. Clarendon Press, Oxford, 1890. Reference on p. 252.

[2] T. J. Westropp: Brasil and the Legendary Islands of the North Atlantic: Their History and Fable, *Proc. Royal Irish Acad.*, Vol. 30, Section C, pp. 223-260, Dublin, 1912. Reference on p. 230.

This narrative is longer and more detailed than that of the Book of Lismore and gives more plentiful indications of voyaging, especially toward the end, in southern seas. In its picture of volcanic fires it recalls occasional outbursts of Teneriffe and its neighbors. ''They saw a hill all on fire, and the fire stood on each side of the hill like a wall, all burning.'' A visit is also recorded to a neighboring land, apparently continental, which the adventurers penetrated for forty days' travel to the banks of a magical river, whence they brought away ''fruit and jewels.'' This may well be meant for Africa, obviously quite near these Fortunate Islands.

Attempts to Explain the Origin of the Brendan Narratives

It has been intimated that the narratives of ''St. Brendan's Navigation'' may have originated in misunderstood tales of his early sea wanderings around the coasts of Ireland seeking for a monastery site. He was successful in this at least, being best known (excepting as a discoverer) for the great religious establishment at Clonfert, not the first which he founded in the sixth century but the most widely known and the greatest.

Another explanation casts doubts upon his real existence and supposes the story of the discoveries to have arisen by confusion of language with the well-known pagan ''Voyage of Bran,'' perhaps the earliest of the ancient Irish Imrama, or sea sagas.

It has also been said that the origin of the Brendan narratives may be found in ''a ninth-century sermon elaborated up to its present form by the eleventh century.''[3] A ninth-century manuscript is said to be in the Vatican library.

A Norman French Version

A Norman French translation was turned into Norman French verse by some trouvère of the court for the benefit of King Henry Beauclerc and his Queen Adelais early in the twelfth century and partly translated metrically into English for *Blackwood's Magazine* in 1836. It avers that the saint set sail for an

Isle beyond the sea
Where wild winds ne'er held revelry,
But fulfilled are the balmy skies
With spicy gales from Paradise;
These gales that waft the scent of flowers
That fade not, and the sunny hours
Speed on, nor night, nor shadow know.[4]

They sail westward fifteen days from Ireland; then in a month's calm drift to a rock, where they find a palace with food and where Satan visits them but does no harm. They next voyage seven months, in a direction not stated, and find an island with immense sheep; but, when they are about to cook one, the island begins to sink and reveals itself as a "beast." They reach another island where the birds are repentant fallen angels. From this they journey six months to an island with a monastery founded by St. Alben. They sail thence till calm falls on them and the sea becomes like a marsh; but they reach an island where are fish made poisonous by feeding on metallic ores. A white bird warns them. They keep Pentecost on a great sea monster, remaining seven weeks. Then they journey to where the sea sleeps and cold runs through their veins. A sea serpent pursues them, breathing fire. Answering the saint's prayer, another monster fights and kills the first one. Similarly a dragon delivers them from a griffin. They see a great and bright jeweled crystal temple (probably an iceberg). They land on shores of smoke, flame, blast, and evil stench. A demon flourishes before them, flies overhead, and plunges into the sea. They find an island of flame and smoke, a mountain covered with clouds, and the entrance to hell. Beyond this they find Judas tormented. Next they find an island with a white-haired hermit, who directs them to the promised island, where another and altogether wonderful holy man awaits them, of whom more anon.

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[3] T. J. Westropp, *op. cit.*, p. 229.

[4] The Anglo-Norman Trouveres of the 12th and 13th Centuries, *Blackwood's Edinburgh Mag.*, Vol. 39, 1836, pp. 806-820; reference on p. 808.

In this version, as in others, there are passages—such as the mention of extreme cold and the account of a great floating structure of crystal—which imply a northward course for their voyage in some one of its stages. So greatly was Humboldt impressed by this and by the insistence on the Isle of Sheep, which he identified with the Faroes, that he restricted in theory the saint's navigation to high latitudes.[5]

THE PROBABLE BASIS OF FACT

But it is noticeable that every version gives St. Brendan the task of finding a remote island, which was always warm and lovely, and chronicles the attainment of this delight, though he finds other delectable islands near it or by the way. The metrical description before quoted is surely explicit enough, but the Book of Lismore outdoes it in a very revel of adjectives. As though praises alone failed to satisfy the celebrant, he introduces the figure of a holy ungarmented usher—a living demonstration of the benignity of the climate. He was "without any human raiment, but all his body was full of bright white feathers like a dove or sea mew; and it was almost the speech of an angel that he had." "Vast is the light and fruitfulness of the island," he cried in welcome and launched forthwith on a prodigal expenditure of superextolling words outpoured on their new delightful home. It is all perfectly in keeping with the glow and luxuriance of sun-warmed shores and the unique airiness of his spontaneous raiment. Clearly "summer isles of Eden," and nothing that has to do with icebergs or wintry blasts, are called for in this case.

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[5] Alexander von Humboldt: Examen critique de l'histoire de la géographie du nouveau continent, 5 vols., Paris, 1836-37; reference in Vol. 2, p. 166.

About six centuries lie between St. Brendan's experiences and the earliest writing purporting to relate them and generally accepted as to date. Doubtful manuscripts and miscellaneous allusions—also often doubtful—may lessen the gap; but at best we have several centuries bridged by tradition only, and that rather inferred than known. It seems likely that he really visited and enjoyed some remote lovely islands, removed but not very often reached from the mainland, such as could in any age have been discovered among the eastern Atlantic archipelagoes. In doing so he might well meet with surprising adventures, readily distorted and magnified; and the first tales of them would be basis enough for the florid fancy of Celtic and medieval romancers, growing in extravagance with passing generations.

The Cartographic Evidence

That he found some island or islands was certainly believed, for his name is on many maps in full confidence. But as to the particular islands thereby identified we find that conjecture had a wide range, varying in different periods and even with individual bias.

The Hereford Map of circa 1275

Probably its first appearance is on the Hereford map of 1275 or not much later,[6] the inscription being "Fortunate Insulae sex sunt Insulae Sct Brandani." It is about on the site of the Canary group, and the elliptical island Junonia is just below. The showing is uncertain and conventional; also the number six misses the mark by one; still there can be no doubt that the Canaries as a whole were intended. Concerning them Edrisi had observed, about 1154: "The Fortunate Islands are two in number and are in the Sea of Darkness." Perhaps he had Lanzarote and Fuerteventura, the most accessible pair, especially in mind. The surviving derivatives of the last eighth-century Beatus map also bear the inscription "Insulae Fortunate" where the Canary Islands should be, but they assert nothing of "St. Brandan." Doubtless, dimly known, they had been reputed Isles of the Blest from prehistoric times. If St. Brendan found them, he found them already the "Fortunate Isles."

A tradition long survived—perhaps survives still—in the Canary archipelago supporting this identification by the Hereford map. Thus Father Espinosa,[7] who long dwelt in Teneriffe and wrote his book there between 1580 and 1590, avers that St. Brendan and his companions spent several

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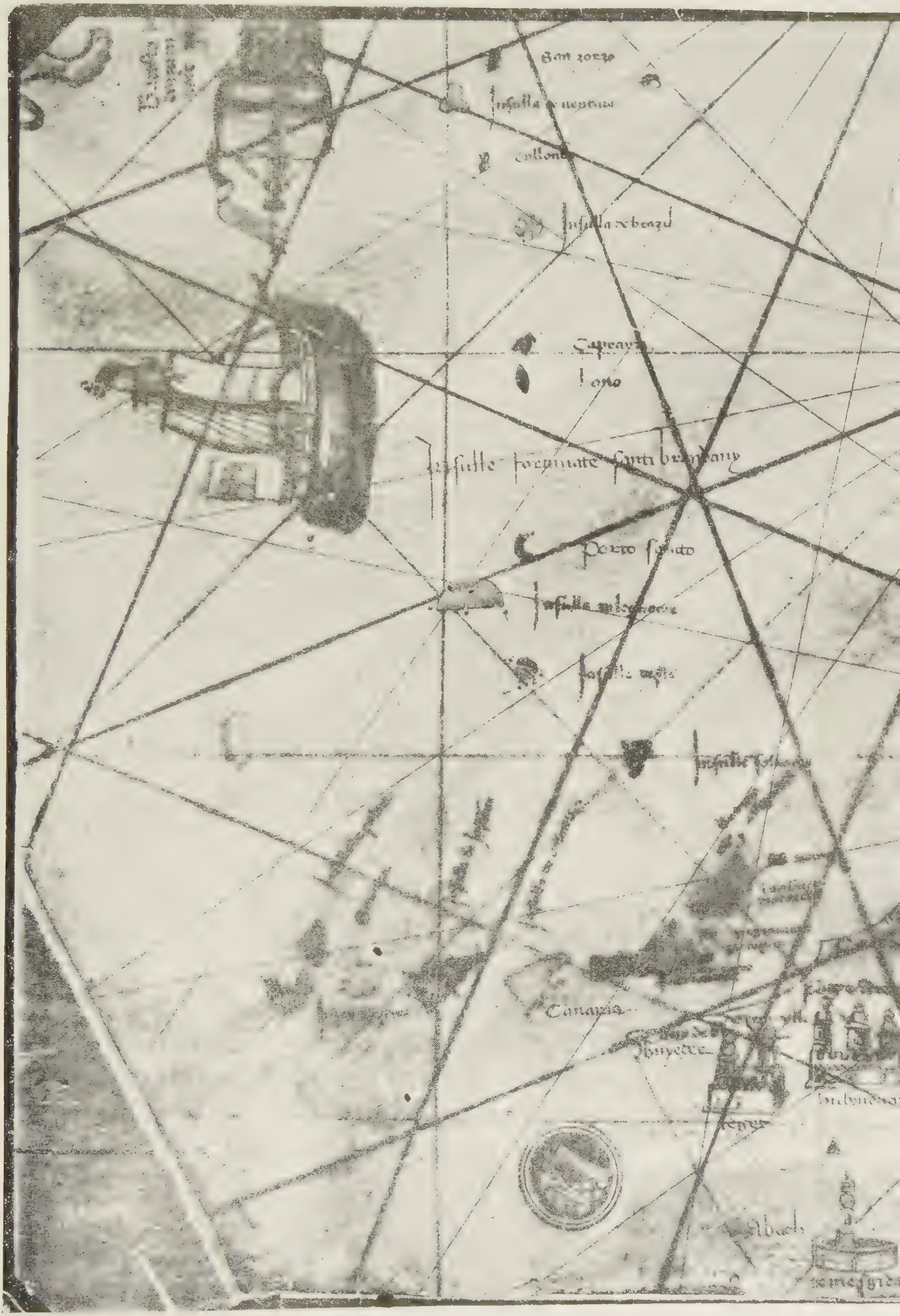
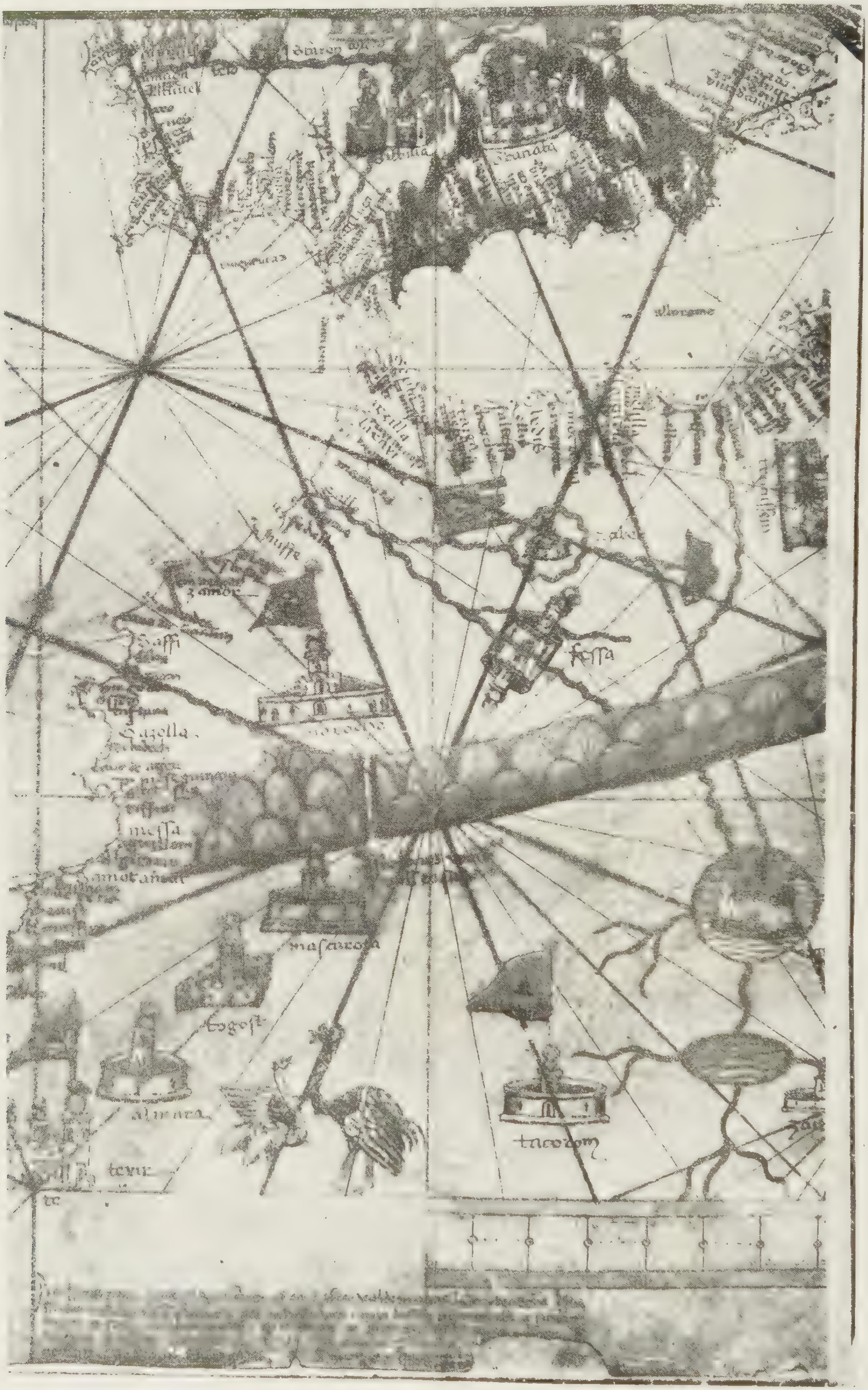
[6] R. G. Benedict: The Hereford Map and the Legend of St. Brandan.

[7] The Guanches of Tenerife: The Holy Image of Our Lady of Candelaria and the Spanish Conquest and Settlement. By the Friar Alonso de Espinosa of the Order of Preachers. Translated and edited, with notes and an introduction, by Sir Clements Markham. *Hakluyt Soc. Publs.*, 2nd Series, Vol. 21, London, 1907. Reference on p. 29.



Photograph of a section of a hitherto unpublished map by Battista Beccari



1426, from the Munich Library, showing St. Brendan's islands.

years in that archipelago and quotes a still earlier "calendar," date not given, as authority for their mighty works done there "in the time of the Emperor Justinian." Even as late as the eighteenth century an expedition sailed from among them for an island believed to be outside of those already known and to be the one discovered by St. Brendan.

The Dulcert Map of 1339

The second cartographical appearance of the saint's name seems to be in the portulan map[8] of Angelinus Dulcert, the Majorcan, dated 1339, where three islands corresponding to those now known as the Madeiras (Madeira, Porto Santo, and Las Desertas) and on the same site are labeled "Insulle Sa Brandani siue puelan." Since *u* was currently substituted for *v*, and *m* and *n* were interchangeable on these old maps, the last two words should probably be read "sive puellam." However the ending of the inscription be interpreted, there can be no doubt about St. Brendan and his title to the islands—according to Dulcert. And that this island group must be identified with Madeira and her consorts (though Madeira is named Capraria and Porto Santo is named Primaria) hardly admits of any question.

If the identification of them with the Fortunate Islands especially favored by St. Brendan were no more than a conjecture of Dulcert or some predecessor, it still had a certain plausibility from the facts of nature and the favorable report of antiquity. Strabo may have borne these islands in mind when he wrote: "the golden apples of the Hesperides, the Islands of the Blessed they speak of, which we know are still pointed out to us not far distant from the extremities of Maurusia, and opposite to Gades."[9] Apparently, too, Diodorus Siculus, writing half a century or so before the Christian era about what happened a thousand years earlier still, means Madeira by the "great island of very mild and healthful climate" and "in great part mountainous but much likewise champaign, which is the most sweet and pleasant part of all the rest";[10] whereto the Phoenicians were storm-driven after founding Cadiz and which the Etrurians coveted but the Carthaginians planned to hold for themselves. Even since those old days there has been a general recognition of Madeira's balminess and slumberous, flowery, enticing beauty.

The Map of the Pizigani of 1367

Divers maps of the fourteenth and fifteenth centuries do not contain the name of St. Brendan (it is perhaps never spelled Brendan in cartography) and hence do not count either way. But the identification of the notable map of 1367 of the brothers Pizigani[11] is the same as Dulcert's, the inscription being also given in the alternative. Like many oceanic features of this strange production it is by no means clear, but seems to read "Ysole dctur sommare sey ysole pone+le brandany." Perhaps it is to be understood as the "islands called of slumber or the islands of St. Brandan." There is at any rate no doubt about the last word or its meaning. But, as if to place the matter beyond all question, a monkish figure, generally accepted as that of the saint himself, is depicted bending over them in an attitude of benediction.

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[8] A. E. Nordenskiöld: Periplus: An Essay on the Early History of Charts and Sailing Directions, Stockholm, 1897, Pl. 8.

[9] The Geography of Strabo. Literally translated with notes. The first six books by H. C. Hamilton, the remainder by W. Falconer. 3 vols., H. C. Bohn, London, 1854-57. Reference in Vol. 1, p. 226.

[10] The Historical Library of Diodorus the Sicilian, in 15 Books. To which are added the fragments of Diodorus, and those published by H. Valesius, J. Rhodomannus, and F. Ursinus. Translated by G. Booth, Esq., in two vols., London, 1814. Reference in Vol. 1, Bk. 5, Ch. 2, pp. 308-309.

This map evidently does not copy from Dulcert, for the forms, proportions, and individual names of the islands all differ. It calls the chief island Canaria, instead of Capraria or the later Madeira, and appends a longer name, which seems like Caporizia, to what have long been known as Las Desertas, which appears greatly enlarged on it. Porto Santo is left unnamed on the map, perhaps because it lies so close to the general name of the group.

First Use of "Porto Santo" as Name of One of the Madeiras

A claim has been set up by the Portuguese that Porto Santo (Holy Port) was first applied to this island by their rediscoverers of the next century in honor of their safe arrival after peril, but this is abundantly confuted by its presence on divers fourteenth-century maps, notably the Atlante Mediceo[12] of 1351. Also the Book of the Spanish Friar,[13] dating from about the middle of that century, contains in his enumeration of islands the words "another Desierta, another Lecname, another Puerto Santo." It would seem to have been a familiar appellation about 1350 or earlier, and the suggestion naturally occurs that it may have originated in the tradition of the visit and blessing of the Irish saint. At any rate, the Portuguese can have had nothing to do with conferring it.

Animal and Bird Names of Islands

Concerning such names as Canaria, Capraria, etc., which, by reason of other associations, appear oddly out of place in this group, the more general question is raised of the tendency to apply animal and bird names to Eastern Atlantic islands. Goat, rabbit, dog, falcon, dove, wolf, and crow were applied to various islands long before the Portuguese visited the Madeiras and Azores, finding them untenanted; these names long held their ground on the maps, and some of them are in use even now. The reason for their adoption piques one's curiosity. If they could be taken as throwing any light on the fauna of these islands in 1350, they might also instruct us as to the probability of prior human occupancy or previous connection with the mainland. But, of course, in any significant instances some fancied resemblance of aspect may have suggested the name.

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[11] [E. F.] Jomard: Les monuments de la géographie, ou recueil d'anciennes cartes européennes et orientales . . . ., Paris, [1842-62]; Pl. X, 1. Also W. H. Babcock: Early Norse Visits to North America, *Smithsonian Misc. Colls.*, Vol. 59, No. 19, Washington, D. C., 1913, Pls. 1 and 2.

[12] Theobald Fischer: Sammlung mittelalterlicher Welt- und Seekarten italienischen Ursprungs, 1 vol. of text and 17 portfolios containing photographs of maps, Venice, 1877-86; reference in Portfolio V (Facsimile del Portolano Laurenziano-Gaddiano dell' anno 1351), Pl. 4.

[13] Book of the Knowledge of All the Kingdoms, Lands, and Lordships That Are in the World, and the Arms and Devices of Each Land and Lordship, or of the Kings and Lords who Possess Them. Written by a Spanish Franciscan in the middle of the 14th century. Published for the first time with notes by Marcos Jiménez de la Espada in 1877. Translated and edited by Sir Clements Markam. *Hakluyt Soc. Publs.*, 2nd Ser., Vol. 29, London, 1912. Reference on p. 29.

MADEIRA

Madeira, meaning island of the woods or forest island, is a direct Portuguese translation from the Italian "I. de Legname" of the Atlante Mediceo and various later maps, and of the "Lecname" of the unnamed Spanish friar who tells us he was born in 1305. It is sufficiently explained by the former condition of the island, the northern part of which is said to preserve still its abundant woodland. Perhaps the modern name of Madeira (or Madera) first appears on the map of Geraldi of 1426, not very long after the rediscovery. But, with some cartographers, the Italian form of the name lingered on much later.

THE BECCARIO MAP OF 1426

The alternative names, which had been given the Madeira group by Dulcert and the Pizigani, commemorating both the general fact of repose or blessedness and the delighted visit of St. Brendan, were closely blended (in what became the accepted formula) by the 1426 map of Battista Beccario, which unluckily has never been published in reproduction. Before the war, however, the writer obtained a good photograph of a part of it from Munich and herewith presents a section recording the words "Insulle fortunate santi brandany" (Pl. I). The first *a* of the final name may possibly be an *e*, having been obscured by one of the direction lines; but I think not. Beccario repeats the same inscription in his very important and now well-known map[14] of 1435, substituting "sancti" for "santi" by way of correction.

With no serious variations, this name, "The Fortunate Islands of St. Brandan" (or Brendan), is applied to Madeira and her consorts by Pareto (1455), Benincasa (1482), the anonymous Weimar map formerly attributed to 1424 but probably of about 1480 or 1490, and divers others. In several instances (the Beccario maps, for example) the words are almost as near to the most southerly pair of the Azores, next above them, as to the Madeiras below, and it is possible that the condition of special beatitude was understood as extending to the former also.

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[14] Gustavo Uzielli: Mappamondi, carte nautiche e portolani del medioevo e dei secoli delle grandi scoperte marittime construiti da italiani o trovati nelle biblioteche d'Italia, Part II (pp. 280-390) of "Studi Bibliografici e Biografici sulla Storia della Geografia in Italia," published on the occasion of the Second International Geographical Congress, Paris, 1875, by the Società Geografica Italiana, Rome, 1875; reference on Pl. 8 (the second edition, Rome, 1882, does not contain the plates). Also W. H. Babcock, work cited in footnote 11, Pl. 4.

The Bianco Map of 1448

At any rate, the verdict of the fifteenth century for Madeira was by no means unanimous. The 1448 map of Bianco,[15] which is very unlike his earlier one of 1436 so far as concerns the Atlantic, was prepared after all the Azores had been found again by the Portuguese except Flores and Corvo. It shows the old familiar inaccurately north-and-south string of the three groups of the Azores as they had come to him conventionally and traditionally, for evidently he did not dare or could not bring himself to discard them. But it also shows a slanting array of islands farther out, arranged in two groups respectively of two islands and five islands each and much more accurately presented as to location and direction than the old Italian standbys. These are quite clearly the Portuguese version, brought down to that date, of the newly rediscovered Azorean archipelago. But Bianco was obviously put to it to conjecture what islands these might be. He drew names from miscellaneous sources: in particular the largest island of the main group, corresponding to Terceira, bears the title "y^{a} fortunat de sa. beati blandan." Nevertheless, he shows and names Madeira, Porto Santo, and Deserta in their usual places. Evidently he had given up, if he ever held, all thought of annexing St. Brendan's special blessing to them. He seems very confident of the St. Brandan's island of his slanting series, for it is drawn heavily in black and contrasts with the rather ghastly aspect of some neighbors. It has nearly the form of a Maltese cross, with long arms, but there is no reason to suppose that this has any significance.

Behaim's Globe of 1492

About the same period a Catalan map[16] of unknown authorship, without copying details, adopted the same expedient of duplicating the Azores by adding the new slanting series. It is quite independent in details, however, omitting mention of "St. Brandan" in particular, though Ateallo (Antillia?) is given in the second group but not in the corresponding place. This may possibly indicate some confusion of Antillia with St. Brandan's Island, such as is more evident in the transfer of the traditional outline of the former to the latter, little changed, by Behaim on his globe of 1492.

As it stands, this globe undoubtedly gives an original and unique representation of St. Brandan's Island far west of the Cape Verde group and emphasizes it by showing Antillia independently in a more northern latitude and less western longitude and also of quite insignificant size and form. But Ravenstein, who made a very thorough study of the matter, tells us[17] that this globe has been twice retouched or renovated and that the only way to ascertain exactly what was originally delineated is to treat it as a palimpsest and remove the accretions. In particular, he relates the story of an expert geographer who found the draftsmen about to transpose St. Brandan's Island and Antillia; but they yielded to his protest. Of course, it is impossible to be quite certain that these map figures are such and in such place as Behaim intended or that they bear the names he gave. The presumption favors the present showing, generally accepted as authentic. It gives the saint only one island, but this a very large one, set in mid-ocean between Africa and South America.

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[15] Theobald Fischer, *op. cit.*, Portfolio XI, Pls. 3 and 4.

[16] *Ibid.*, Portfolio XIII, Pl. 5.

Possibly this location may be suggested by an undefined coast line shown by Bianco's map of 1448, previously mentioned, and, like Behaim's island, set opposite the Cape Verde group. In Venetian Italian it bears an obscure inscription, which calls it an "authentic island" and is variously interpreted as saying that this coast is fifteen hundred miles long or fifteen hundred miles distant. The map of Juan de la Cosa (1500) exhibits off the coast of Brazil, and with an outline similar to Behaim's, "the island which the Portuguese found." His date is too late to have influenced Behaim, too early to have been prompted by Cabral's accidental discovery of that very year. It is more likely that he and Behaim both were acquainted with Bianco's work or that all three drew from the same report of discovery.

Later Maps

From this time on there is never more than one island for St. Brendan, but it indulges in wide wanderings. Especially as the attention of men was attracted to the more northern and western waters, the map makers shifted the island thither. Thus the map of 1544 purporting to be the work of Sebastian Cabot and probably prepared more or less under his influence,[18] places the island San Brandan not far from the scene of his father's explorations and his own. It lies well out to sea in about the latitude of the Straits of Belle Isle. The Ortelius map of 1560 repeats the showing with no great amount of change. In short, the final judgment of navigators and cartographers, before it quite vanished from the maps, made choice of the waste of the North Atlantic as its most probable hiding place. Perhaps this westward tendency in rather high latitudes may be partly responsible for the hypotheses in recent times which have taken the explorer quite across to interior North America on a missionary errand.

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[17] E. G. Ravenstein: Martin Behaim, His Life and His Globe, London, 1908, p. 59.

[18] S. E. Dawson: The Voyages of the Cabots in 1497 and 1498; With an Attempt to Determine Their Landfall and to Identify Their Island of St. John, *Trans. Royal Soc. of Canada*, Vol. 12, Section II, 1894; map on p. 86. The map is also reproduced by Jomard, in the work cited in footnote 11.

There is certainly nothing to prohibit any one from believing them, if he can and if it pleases him.

Conclusion

In general review it appears likely that St. Brendan in the sixth century wandered widely over the seas in quest of some warm island, concerning which wonderful accounts had been brought to him, and found several such isles, the Madeira group receiving his special approval, according to the prevailing opinion of the fourteenth and fifteenth centuries. But this judgment of those centuries is the only item as to which we can speak with any positiveness and confidence.

MAPPING THE UTILIZATION OF THE LAND*

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General Principles

The principles of geographic mapping, properly so called, can hardly be said to be formulated. Geographic field work is still in its beginnings, and the geographic survey is not even projected. The mapping which the geographer must develop in connection with his studies will not be for the purpose of exhibiting topography, soils, or vegetation. Maps such as these he may be obliged to prepare in the course of his work if they are not already at his hand. The true geographic map, although based on maps of the sorts mentioned, must attempt to set forth economic conditions. Certainly the aim of such a map must be to represent the ways in which the people of the area make their living and the character of this living, in so far as these things can be confined within the inelastic frame of a map.

The Existing Economic Map

There exists at present one type of map that attempts to cover the field of pure geography, the so-called economic map. Usually it is prepared for a complex group of economic conditions and for large areas and is intended for classroom use. We have, for example, economic or industrial maps of North America, which attempt to show the important agricultural areas, forest tracts, mining districts, transportation lines, commercial centers, and even other features. The technique of these maps has not been worked out satisfactorily—perhaps it lies beyond the graphic capacity of an individual drawing. The symbols employed become complicated and confusing. They are hence of little use for the purpose of instruction, for which they are made. They encounter a still greater difficulty in the extraordinary amount of generalization which they involve and in the consequent, perhaps irrepressible, conflict between their graphic qualities and truth.

An Improved Economic Map

The problem may be attacked at the other end, in the mapping of a small area on a large scale. In this way simplicity of material is secured, and the amount of generalization is much reduced. To be successful, such a map should build up a panorama of its area and should definitely and completely represent the area both as the home and the place of business of the group that inhabits it. The analysis, thus undertaken, may be expected to bring out the distribution of the significant activities of the area, to suggest their interrelations, and to indicate the local opportunities and disabilities of production. This means a census-taking in map form, with two principal problems, a major one of selecting the economic conditions to be represented, and a secondary one of securing proper graphic expression. The present paper is concerned primarily with the former problem.

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* This paper may be considered to form the third in a series by the author, the first two of which have already been printed. These are: Proposal of an Agricultural Survey on a Geographic Basis, *19th Ann. Rept. Michigan Acad. of Sci.* (*1917*), pp. 79-86; A Soil Classification for Michigan, *20th Ann. Rept. Michigan Acad. of Sci.* (*1918*), pp. 83-91.

The minimum essential of a geographic map is that it shall portray the use to which the entire land surface is put. Possibly also it may be made to show the relative value of the different types of use and the degree of effectiveness of the utilization. A map of this sort is the final member of a trilogy, of which the other two are the topographic map and the soil map. It is the outgrowth of the two that precede it, is explained by them, and, in turn, serves to interpret them.

Grouping of Land Utilizations

Since utilization is the keynote, the map must distinguish first of all between productive and non-productive areas, or else between what the United States Census designates as improved and unimproved land. In the former classification the critical element is yield, in the latter, labor. In spite of their similarity the two concepts cannot be used interchangeably. All cultivated land is, of course, both improved and productive. Pastures and meadows are productive, but may be improved or unimproved, according to the manner of their establishment. It is desirable to keep in mind both sets of criteria, giving, however, major emphasis to the matter of productivity. In this way land utilizations may be classified in the following groups: (1) barrens, (2) woodlands, (3) permanent pastures and meadows, (4) cultivated lands, (5) town sites.

Barrens

In barrens are included areas too destitute of vegetation to serve for grazing or cutting of timber, such as recent sand dunes, beaches, and areas of bare rock. In general this is permanently waste land, in so far as direct use of soil and surface is concerned. Doubtful cases may be found in burned-over tracts in which the humus has been destroyed and the soil baked and in areas of severe soil erosion.

Woodlands

A double classification of woodlands is needed: (1) the first to designate *type* of forest growth, which may be by the method of the ecologist or by the similar forest-composition classification of the forester; (2) the other to show the *condition* of the forest. The latter opens up in part new problems, as the work of the Forest Service has been concerned with large tracts of forest and these have been differentiated mainly by composition and age. A grouping may be worked out on the following lines:

(a) Wood lots. Under this heading fall the smaller forest tracts in the agricultural sections, chiefly woods that belong to farms. The ordinary wood lot is not held for the value of its timber but is an appendage to the farming land and consists of land for which there has not been the time or means of clearing or else of land that it is difficult or undesirable to clear. Often it is a general utility tract on the poorest part of the farm. Here firewood and fence posts are secured, and stock is pastured when it is not desirable to have it on the usual pastures. It is not significant whether it contains valuable timber or not. Its principal importance is its place in the general economy of the farm, not as a distinct investment in timber land.

(b) Cut-over lands, including non-commercial ''second growth.'' This is land from which at least the more valuable forest has been removed but which has not been diverted to other uses. It is temporarily therefore in a non-productive condition or nearly so. The classification is applicable only to large tracts. Small portions ordinarily are parts of farms and are there classified as wood lots or stump pastures. There may be irregular and incidental production from these lands, but in the main they are now waste lands, compared with what they once were and may become again. Where fires or erosion have followed deforestation in such manner that the soil is gone and where therefore forests cannot return within a reasonable number of years, the land should be placed in the ''Barrens'' class.

(c) Commercial timber land. In this case land will be valuable immediately and primarily for its timber. The line between cut-over land and timber must be drawn according to local circumstances that determine what constitutes commercial timber. Where mill lumber only is being produced, the yield in saw logs will determine the status of the forest tract. In other places a certain amount of timber of tie size and quality will be prerequisite to classification as of commercial value. This will be the ordinary condition. The modern forest survey covers determination of stand and merchantability in detail, and guidance may be had from this source. Tracts mapped as commercial timber should be kept distinct from all forest lands of the wood lot type.

Timber of scrub growth as a rule will be identified sufficiently by the ''type'' classification, as, for instance, blackjack oak and jack pine. A separate ''condition'' classification for scrub growths seems therefore unnecessary. For those rare instances in which forestry is being applied and in which the forest land is being made into a permanently producing tract, a third classification may be introduced by means of a superimposed symbol to indicate ''treatment.''

Permanent Pastures and Meadows

Under permanent pastures and meadows belong: (a) meadows, areas of wet land from which hay is cut and which may also be used at times for pasturage; (b) wood and stump pastures, partially cleared forest lands in transition from forest to grass land. These are used primarily for grazing, the timber being a remnant of small significance in the utilization of the land. There should also be included (c) other wild pastures, such as upland pastures on thin, dry soils, and (d) seeded pastures, a rare type of permanent pasture land, as most seeded pastures represent a temporary use of cultivated land.

Cultivated Lands

The major divisions of cultivated lands are well established, namely agricultural and horticultural uses of land. In horticulture further simple subdivisions are possible because the product of an individual tract ordinarily remains the same through a series of years. We have therefore orchards, vineyards, truck land, and so on. In agricultural use, on the other hand, the crop of the individual field is commonly changed at frequent intervals. It is true that there are large districts in the South in which cotton is grown on a field continuously over long periods and that similarly there are lands in the Middle West on which nothing but corn is ever produced. Single-crop practices, however, are becoming more and more exceptional. Ordinarily the cropped lands can be distinguished best by crop series. In a crop series are to be included all the important crops commonly grown on the tract in question. The simplest illustration is found in the crop rotation. Here a certain number of crops are produced in a definite succession. A crop rotation constitutes a crop series, but the latter term is more comprehensive. Thus we may have a corn-oats-clover series in which these three crops may be grown (1) in definite rotation, (2) in accidental succession, or (3) under a system in which one farmer may emphasize one crop, a second another, according to individual choice. In spite of these variations of practice it should be readily recognizable that the utilization of a particular type of land is in the growing of one of these crops or of the group of them. A second series may be wheat-oats-timothy-clover. An individual crop therefore may appear in the designation of more than one crop series. The map, as executed on this basis, will differ widely from the crop of an individual year and even from such a map of a series of years. It is in fact not a crop map but a map of cropping practice. It will represent the formulas for the relation of cropping practices to type of land. The order in which crops appear in the series is of course not the order which they follow on the land, but a grouping according to their relative importance in the cropping practice. The most profitable crop or the most widely raised crop would therefore appear first. These series, it is believed, are in general in quite definite relation to type of land. Over most of the country farm practices are fairly well established. Even where they do change, a successful group of crops is more commonly expanded than abandoned. It is believed therefore that such a map will represent a considerable degree of stability.

Town Sites

Interesting and valuable studies may be made of the distribution of land use in an urban district. The distribution of residence sections of varying conditions, parks, vacant property, factory districts, retail business, wholesale and warehouse districts, and shipping terminals furnishes a field of inquiry that is almost untouched by the geographer. In this connection mapping would furnish material for detailed analysis of the locational factor in the evolution of a city. This study of dominant focal points and the distances of their influence is impossible without such a map and hence remains mostly undone. Work of this type would contribute valuable data to the ''city plan'' idea. The city plan is an attempt to find the best use of the land that constitutes the city. In other words, it tries to discover the geographic adaptations of the sections of a city instead of leaving this discovery to the scarcely less sure but vastly slower workings of natural growth.

Value of This Plan of Mapping

The outline as given emphasizes throughout the fact of productivity and differentiates between those areas that are at work and those areas that are being carried along as incumbrance. The plan also attempts to characterize manner and degree of utilization. Beyond these general principles it does not appear desirable to lay down a scheme of classification. Local conditions will point the necessary modifications for translating such a plan into practice.

Mapping of the land by such a plan supplies a definite objective to the geographer by a relatively exact method. It keeps in view its definite purpose, the intensive study of regional geography, and approaches it by a route that is direct though hard and tedious. It eliminates facile generalizations and the plausible and insecure reconnaissances that constitute too large a part of geographical literature. It invites, and probably necessitates, the co-operation of the economist, the agronomist, and the forester. In addition to furnishing badly needed material to the student of regional geography the mapping may serve broader purposes. The cognate fields of economics, agronomy, and forestry can draw therefrom. To the man financially interested in the area the map gives information of economic conditions. To the traveler it explains the country. The strategic value of such a map is indicated by the great detail in which military maps represent the use to which the land is put. In combination with soil maps this type of map may be utilized in the equalization of taxes, not merely by boards of review but also as a partial foundation for a scientific system of tax assessment, an institution that we now lack. Expectations of these and other possible uses are based on the fact that the projected map is a mode of analysis of economic conditions.

Its Final Application

There remains the final application of the study. By the time the plan has been converted into a map for a given area, the economic situation of that area is well understood. Hence the prospects of future development should be apparent. The next step, accordingly, is to state the most appropriate future uses of the land. Is land being cultivated that should not be? Is land idling that could be making a satisfactory growth of trees? Are there undeveloped grazing areas? What wild land may be developed as farm land in fairness to the men who will live upon it? The study of present utilization must inevitably bring up questions such as these. The map that shows land utilization is logically succeeded by the map that provides land classification. The economic map of the present must point out both nature and extent of the wastes and abuses of land. The land classification map, then, will indicate the best and most complete use of the land in the immediate future, especially the protection of lands that are being used improperly, the development of needlessly idle lands, and the change in the use of lands now unprofitably employed. Land classification proposes stimulated and remedial use, not by the assertion of means that are ultimate and without alternative but along lines that are proximate and feasible. The three steps follow inexorably: first the study of the soil, then the study of existing conditions, and finally the program to secure the best results possible in any near future.

Example

In connection with a detailed geographic study of a small area, a map of the type projected has been made.[1] The area involved is Bridgewater Township, Saginaw County, Michigan. Relief throughout is slight, as the area consists of lake beds and beaches, a water-laid moraine, and an obscure flood plain. The soils are silty and sandy, the sand content in general increasing as one goes south. There is no absolutely waste land. The main problem lies in the representation of agricultural use.

The original map recorded the employment of fields down to five-acre tracts in the crop season of 1918. Detailed notes were kept on crop practices. From this work it shortly became apparent (1) that a large number of crops are grown, (2) that the area planted to an individual crop on a single farm is small, and (3) that these crops can be combined into a small number of groups or crop series. The resultant generalization is Figure 1. The major series is hay-oats-corn-pasture. The order expresses the decreasing order of importance in the farm economy of the one type of land. Hay is the first crop. If this area were reduced to a considerably smaller scale

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[1] This work is based on a field study by Miss M. K. Horning in the summer of 1918. The maps here represented are her interpretation of the principles set forth in the previous section.

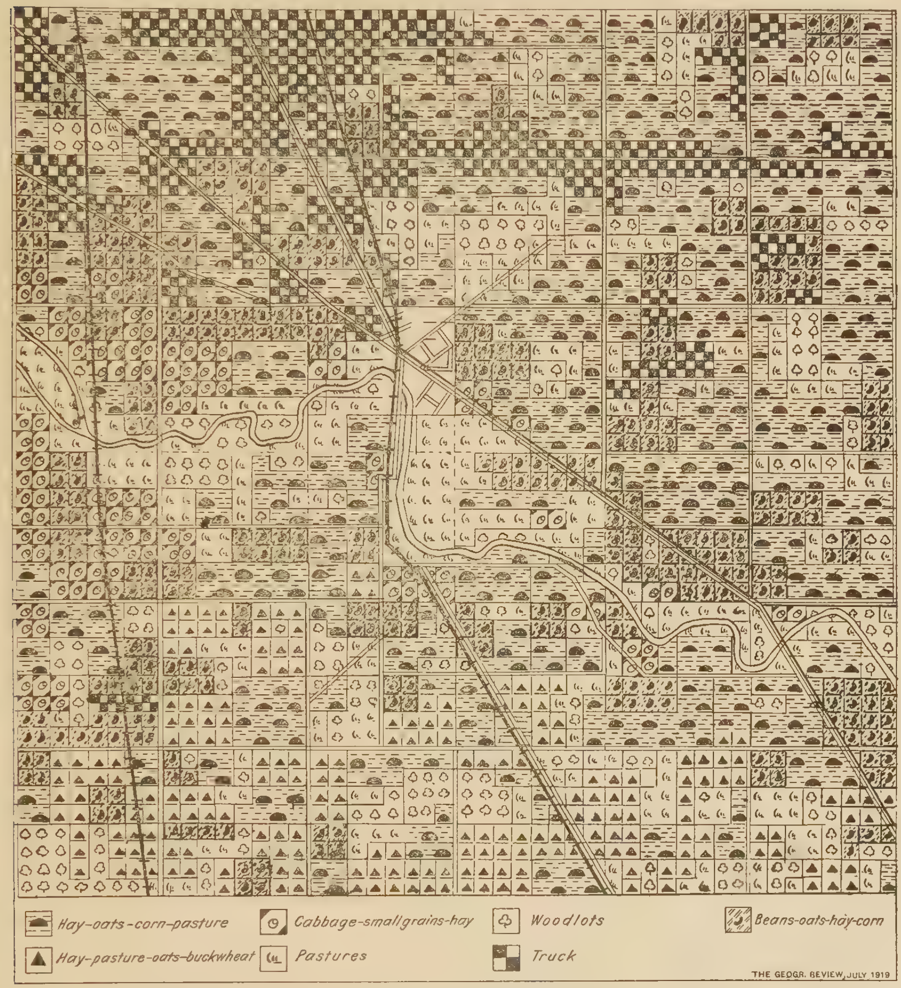

FIG. 1—Map showing, according to the method suggested in the paper, the utilization of the land in Bridgeport Township, Saginaw County, Michigan. Scale, 1:82,000.

map, say a map of Michigan, the entire area might appear as dominated by hay growing. Enough land is cultivated to grow the local supply of oats and much of the corn needed. After a number of years of cultivation fields are usually pastured for a period. The grass culture at both ends of the series suggests the importance of stock-raising. It is in fact a type of mixed small farm that emphasizes stock. With a somewhat more intensive cultivation of the same type of land a series beans-oats-hay-corn emerges, in which the bean crop supplies the farm with ready money. The poor, sandy land to the south gives the group hay-pasture-oats-buckwheat. On rather heavy lake beds cabbage is the most important crop, and the series cabbage-small grains-hay is constituted. Finally there are the truck-growing sections, located mostly on sandy loam and along good roads. The cultivated land represents 71 per cent of the total surface.

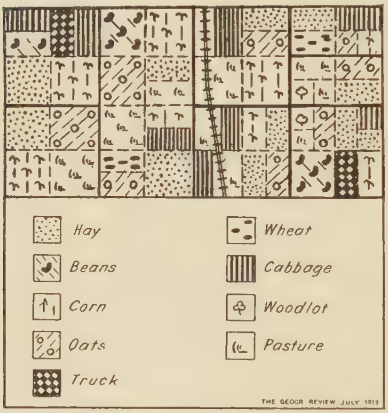

FIG. 2—Map of northern half of Section 19, showing crops as grown in 1918. Scale, 1:31,680. Solid black lines represent farm boundaries, broken lines boundaries of fields.

Figure 2 represents a half section taken from the field map to show actual crop conditions in a typical section of the heavier lands. This is an adaptation of the type of study carried on by the Office of Farm Management of the U. S. Department of Agriculture on individual farms. In the present type of study it is proposed to supplement the generalized map of the type of Figure 1 with ungeneralized maps of the second type to show actual crops in a given year for the different type areas. In the further development of the plan it is expected that field mapping may be done directly in both types. The generalized map may be developed directly in the field by discovering the several crop practices. At type locations a section or even less may then be mapped in the ungeneralized form to furnish the specific illustration of the application of an individual crop practice.

GEOGRAPHICAL RECORD

NORTH AMERICA

Arable Land in the United States. A recent paper on "Arable Land in the United States," by O. E. Baker and H. M. Strong (*Yearbook Dept. of Agric. for 1918*), describes in outline the location and extent of present arable, non-arable, and potentially arable land in this country. Most of the present arable land lies east of the 100th meridian, and this produces four-fifths of the corn, three-fourths of the wheat and oats, and three-fifths of the hay crop of the nation. In order that land may be adapted to the production of crops, several conditions must be met. First, it must not be so stony or hilly as to prevent the use of the plow and of other farm machinery. Nearly one-fifth of the land area of the United States is too hilly or too rough for successful crop production. A second condition is that the rainfall must be sufficient. Where the mean annual rainfall in Montana is less than 12-15 inches, or less than 18 inches in eastern Colorado, 20 inches in the Texas Panhandle, and 25 inches in the lower Rio Grande Valley of Texas, the production of crops without irrigation is a precarious undertaking. The minimum rainfall needed for successful crop production varies from 9 to 30 inches in different parts of the United States, the amount depending on the local conditions of soil and climate. As a general rule, the rainfall requirement increases from north to south with increasing evaporation (under higher temperatures) and with the occurrence of a less favorable seasonal distribution of precipitation. It is estimated that nearly one-third of the land area of the United States receives too little rainfall for profitable crop production at normal prices and has no possibility of irrigation. Occasional years of heavier rainfall than normal result in large profits, but in the long run it is better business policy to use such lands for grazing, raising only a few acres of crops for supplementary feed in swales and seepage basins.

A third condition, also climatic, relates to the length of the growing season. The amount of heat must be sufficient, and the season between the first and last killing frosts must be long enough to mature the crops. Lastly, there are considerable areas where the soil is too sandy or infertile for profitable crop production at prevailing prices. These districts are better adapted to forests. Taken in all, more than one-half of the land area of the United States is unfitted for profitable crop production because of rough topography, deficient rainfall, low temperature, or infertile soil. With the exception of about 40,000,000 acres of desert, this land is used, to a greater or less extent, for the production of wood and timber and for grazing stock.

"Potentially arable land" consists of forest, "cut-over" land, and woodland, including that in farms, covering more than one-tenth of the land area of the country; and also some 60,000,000 acres of swamps and other wet lands susceptible of drainage. A third expansion of the agricultural area is to be sought in the potentially irrigable land which is awaiting development in the West. This is estimated at 30,000,000 acres, if all available sources of water supply were fully utilized, and would double the present area of irrigated land. It is to be noted, however, that the cost of construction of dams and of canals and ditches becomes greater and greater as less and less favorable projects are developed. Even now the supply of land under the ditch and ready for farming in several Federal reclamation projects exceeds the demand at the price quoted. There are, further, about 50,000,000 acres of "unimproved land other than woodland" in the rainier Eastern States, consisting of unused fields, stony upland pastures, "abandoned farms," and waste land. Of this, probably not more than two-thirds will ever be put into crops. Lastly, a further development of dry farming may provide for a few more farmers in the West.

Certain economic considerations have to be taken into account in this matter. The country will require a woodland area of at least 450,000,000 acres to supply a population of 150,000,000 people. Hence, a good deal of potentially arable land will remain in forest. Again, an appreciable portion of land suitable for crops will remain as pasture. It seems probable that the area in crops will never reach the estimated possible total of 850,000,000 acres. The increasing cost of reclamation will lead to a more intensive cultivation of the more fertile or favorably situated land, and to the use of the lower grades of arable land for grazing or timber production. The well-cultivated lowlands and the "abandoned farms" in the highlands of the northeastern states illustrate this tendency.

R. DEC. WARD

American Meteorology and the War. Among the scientific contributions made by the United States towards winning the war, the meteorological work carried on by the Weather Bureau, the Army, and the Navy was of peculiar importance. It is well that, as a chapter in the scientific history of the war, there should be available some authoritative account of the various phases of this work. The *Monthly Weather Review* for April, 1919, contains a series of papers which furnish much general and interesting information on this subject. The most important results accomplished in connection with the "Aerological Investigations of the Weather Bureau During the War," which are discussed by Willis R. Gregg, were (1) the aid given the Army and the Navy in organizing and equipping their meteorological services, and (2) the information and advice furnished both military and naval services regarding free-air conditions. Lieutenant Colonel R. A. Millikan (Signal Corps, U. S. A.), who begins his paper on "Some Scientific Aspects of the Meteorological Work of the United States Army" with the statement that "prior to 1914 a meteorological section was not considered a necessary part of the military service," enumerates four distinct divisions of his problem as follows: the extension of our knowledge of the law of motion of pilot balloons; the procurement of data and the development of methods for the preparation of artillery range tables; the development of long-range propaganda balloons; the charting of the upper air in the United States and overseas, in aid of aviation.

Captain B. J. Sherry and Lieutenant A. T. Waterman describe the work of "The Military Meteorological Service in the United States During the War." The problem was "the project of creating what was in many respects an entirely new service for the Army designed to supply the military organization with complete and up-to-date meteorological information, and this as promptly and efficiently as possible." "The Work of the Aerographic Section of the Navy" is briefly described by Lieutenant Commander Alexander McAdie, U. S. N. R. F., Senior Aerographic Officer, and emphasizes the extraordinarily rapid development of this branch of meteorological activity, which was not organized until January, 1918. Commander C. T. Jewell, U. S. N., retired, gives an account of the "Work of the Naval Observatory in Connection With Naval Aerography," and R. H. Finch, U. S. N. R. F., describes "Meteorology in the Naval Aviation Service Overseas." Other papers are devoted to descriptions of the special forms of instruments or of graphic devices which were used or devised in connection with war meteorology.

The whole series of articles gives an interesting account of the meteorological activities of the United States Government during the war. It is a record of good work, well done, of which the country may be proud. R. DEC. WARD

The Roosevelt Wild Life Forest Experiment Station. Until the recent establishment of the Roosevelt Wild Life Forest Experiment Station at Syracuse, N. Y., there had never been before in America and probably not in the world a station devoted primarily to the study of forest wild life. This first station of its kind is described by Dr. Charles C. Adams, its director, in *Science* for June 6, 1919. The station is a memorial to the late Colonel Theodore Roosevelt in recognition of his interest in and work for forestry and wild forest life. New York State is a particularly appropriate place for such a station not only because it was his home state but because of the large extent of forest land and fresh-water surface, which nearly equals in acreage the extent of tilled land and thus leads to economic and social problems of high rank. The duties of the station are described as follows: "to make investigations, experiments, and research in relation to the habits, life histories, methods of propagation and management of fish, birds, game, and food and fur-bearing animals, and forest wild life." In addition to its conservation features the plan provides for the training of students who wish to specialize in this kind of ecologic work, either as technical forest investigators or as practical foresters interested in the management of fish and game. It is expected that the memorial will receive support from the Legislature of New York as well as from private citizens who wish to honor the memory of Roosevelt.

AFRICA

The French Penetration of Morocco. In 1912, when Morocco came under French protection, the country was being desolated with strife and lawlessness. Already France had been compelled to intervene on the Atlantic seaboard at Casablanca and in the east that marches with Algeria. Real pacification began at the end of April, 1912, with General Lyautey in charge of the formidable task. Two years later the European War broke out, and to those unacquainted with the genius of the Resident General the prospect looked dark indeed—pacification so recently begun and still far from complete; turbulent tribes stirred beyond their wont by ceaseless German intrigue; the government's forces depleted—what hope was there for Morocco? General Lyautey solved the problem by maintaining all the frontier posts and advanced marches intact, by redoubling the initiative of the remaining mobile forces on the untamed front. Since 1914 the area of occupation has been extended and the pacified tribes have remained loyal, nay more, they have offered their services to the cause of France (Augustin Bernard: La France au Maroc, *Ann. de Géogr.*, January, 1917. The map of penetration, reproduced herewith, should be compared with the orographical, rainfall, vegetation, and

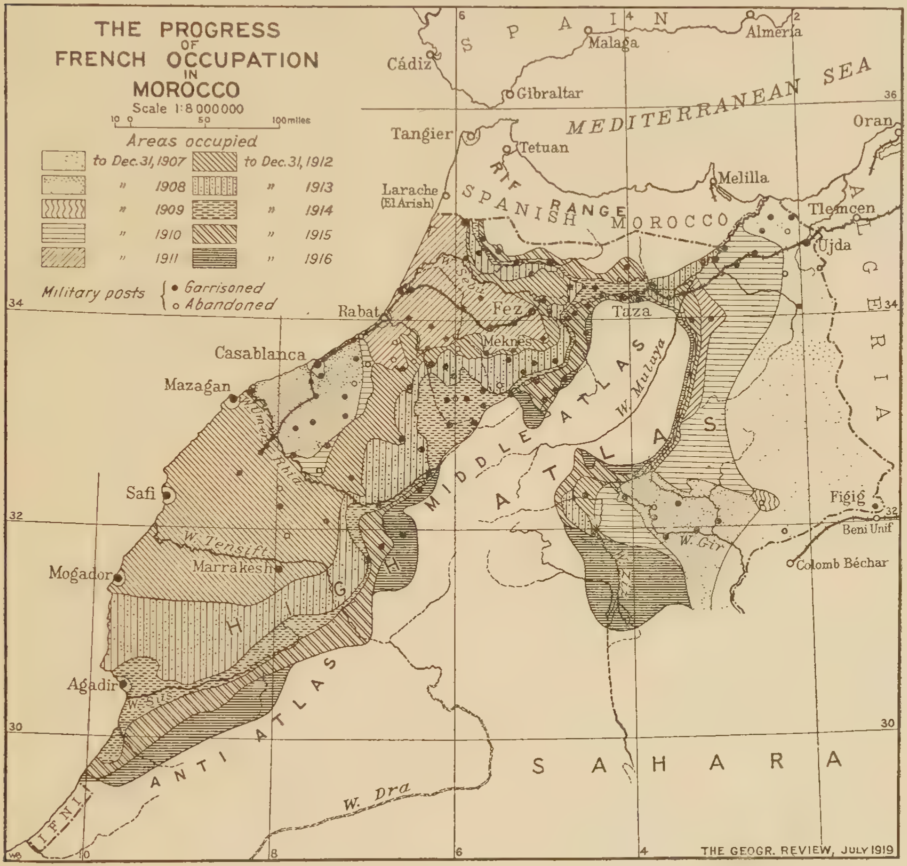

FIG. 1—(Based on a map accompanying the paper cited in the text.)

population maps accompanying Alan Ogilvie: Morocco and Its Future, *Geogr. Journ.*, Vol. 39, 1912, and A. Bernard: Le Maroc, Paris, 1913.)

The progress and policy of French penetration in Morocco can only be understood if the geography of the country be appreciated. Early occupation took place in the most accessible regions, the eastern plain and plateaus that continue the Algerian steppes, the fertile black-earth plains, and the plateaus bordering the Atlantic, the only region accustomed to submission, the only part of the Sherifian Empire really controlled by the Sultan. Separating the eastern and western areas are the chains of the High and Middle Atlas and the Rif of Spanish Morocco. The mountains dominate the plains, and the mountain people, whose order of life is so different from that of the plains, dominate the plainsmen, for they are the perpetual disturbers of the peace. Occupation of the plains alone affords no security; to be master anywhere the central authority must be master everywhere. The least known, the most inaccessible part of the mountain region, is the Middle Atlas, the Gordian knot of French occupation as it is the orographic knot of the country. In the extreme south and, more important, to the north, in Spanish Morocco, are two other insurrectionary centers by which the connecting link of Middle

Atlas Berbers receive German arms and ammunition. In particular, annoyance is still caused by the notorious Raisuli, a brigand who has raised himself to the status of an independent chief. Between the Rif and the Middle Atlas, however, there exists the *couloir* of Taza, the narrow passageway that before the formation of the Straits of Gibraltar was the outlet for the Mediterranean. The Taza *couloir* is a historic route between Algeria and Morocco. Romans, Vandals, and Arabs have passed along it; possession of it is vital to any power claiming authority over northwestern Africa. Hence, despite the dangers while the heights are in enemy hands, it has been occupied; and one of the main objectives of present penetration is the widening of the gap southward; on the north of course nothing can be done. Occupation will shortly be sealed by completion of the railroad. Today (see: La Foire de Rabat, *L'Afrique Française,* Sept.-Nov., 1917) there remains only a short link to connect Taza and Fez and thus unite Algeria with the Atlantic coast. The frontier force is likewise particularly concerned with isolating the two main Berber groups of the Middle Atlas, the Beni-Waraïn with the Riata and the Zaïan. Between them lies a weak spot in the rampart of the Middle Atlas, a gently sloping plateau giving access to the heart of the mountains. It is occupied by the nomadic Beni-Mgild and Beni-Mtir, people who, because of their nomadism, are more approachable than the neighboring Berber tribes, tied to the cultivation of their isolated mountain valleys. South of the Atlas is projected the opening of routes in the Sahara whereby a system of policing may be established in connection with the existing organization of the *méharistes* of Mauritania and southern Algeria, the ''Northwest Mounted Police'' of the Sahara.

Details of the latest movements in Morocco are published in the number of *L'Afrique Française* for January-February, 1919 (pp. 23-28). The extent of German intrigue is very evident: the situation was always in close sympathy with that in Europe. Insurgent endeavors were specially great during April, May, June, July, 1918. News of the armistice was not credited, and there were further outbreaks in December and January, but these appear to have been ''the last wave.''

AUSTRALASIA AND OCEANIA

Hawaiian Forest Reserves. Following the policy established by the United States on the continent, the Hawaiian territorial government has set apart certain well-timbered areas as forest reserves. According to the December, 1918, issue of the *Hawaiian Forester and Agriculturist,* official organ of the Board of Agriculture and Forestry, the designation of five new districts on December 31 completed the area to be so segregated. The latest additions increase the forest reserves by 41,355 acres, bringing the total so set apart in the different islands up to 554,842 acres. Added to this there are some 260,000 acres, which, though still privately owned, it is expected to have protected and administered in a similar way.

To science the Hawaiian forests are of peculiar interest because of their distinctly endemic character. (See an article by Vaughan MacCaughey in the *Plant World,* Vol. 19, 1916, pp. 162-166.) Commercially the only timber of importance is that from the *ohia* and the *koa* trees, the former, a dark, hard, close-grained wood, being used for flooring, railroad ties, and paving blocks, while the latter, the so-called ''Hawaiian mahogany,'' is much prized for its beautiful golden-red wood, suitable for fine cabinet work and for interior furnishings.

The greatest value of the forests, however, is as a protection to the watersheds of the islands. The windward slopes throughout the archipelago receive from 400 to 500 inches of precipitation a year. With the forest cover removed, this heavy rainfall would soon occasion destructive floods and excessive erosion. On the other hand the westward, or leeward, side of the islands is in most cases decidedly arid and can be cultivated only by means of irrigation.

Owing to the porous character of the volcanic soil much of the water now sinks deep into the ground but has been successfully reached by artesian wells. On some plantations the abundant water power of the rainy slopes is utilized to generate electricity, which, wired to the desert districts on the other side of the island, pumps water from wells to irrigate the fields. In 1917, according to the publication cited above (May, 1918) 62 per cent of the sugar, the principal product of the islands, was grown on irrigated land. It would seem evident, therefore, that the continued prosperity of the inhabitants depends in very large measure upon the proper control of the stream flow and the protection of the areas which supply the artesian basins, both of which can be accomplished only by the conservation of the forested districts on the higher lands.

The chief destructive agents are fires, wasteful cutting of timber, and the wild cattle that abound in some of the mountainous districts. Against these the forestry service can contend successfully only when the regions concerned are placed under government administration.

As in other such reserves an attempt is being made to render the districts segregated of further value to the people, by opening some of them for camping sites and by preserving the natural beauties for which the islands have long been famous.

ECONOMIC GEOGRAPHY

Sea Bamboo As a Source of Potash. Among the problems of the war was the manufacture of chemicals formerly derived from Germany or from sources outside of Germany where production was affected by abnormal conditions of trade. Mr. G. F. Britten in the *South African Journal of Science* for October, 1917, published a valuable account of his experience with seaweed as a source of potash in South Africa. There is a variety of seaweed which grows in great abundance near the shores of the Cape peninsula and is known as sea bamboo. The use of seaweed as a fertilizer has been known, of course, for many years. In the Channel Islands seaweed was collected and allowed to dry near the shore and then burned on the household hearths and the ash sold to farmers, who used it on their wheat fields. Seaweed is also used along the New England coast, in California, and many other localities.

Mr. Britten selected for his analyses freshly stranded specimens of sea bamboo. He found that from the trunk portion of the seaweed he could derive an ash containing not less than 33 per cent of potash and from the leaves an ash which contained not less than 22 per cent, which on a pre-war basis would be worth $40 and $27 a ton respectively. He further discusses the direct use of the seaweed and points out that bordering the coast of South Africa are hundreds of different varieties, of which little or nothing is known except the composition, and urges action looking toward the building up of an industry that will yield important results in South African agriculture.

PHYSICAL GEOGRAPHY

Solar Radiation Observations and Weather Forecasting. A very interesting investigation, which may lead to results of unusual importance, is being carried on by the Smithsonian Institution and Mr. H. H. Clayton, Chief of the Division of Forecasts of the Argentine Meteorological Office. Since July 27, 1918, the Smithsonian Astrophysical Observatory has been conducting daily observations at Calama, Chile, of the solar constant of radiation. By means of special devices, and owing to the skill and zeal of the observers, Messrs. A. F. Moore and L. H. Abbot, the determination of the solar constant of radiation is completed on the same day that the observations are made. The result may, if desirable, be telegraphed within ten hours of the beginning of the observations. Mr. H. H. Clayton, at Buenos Aires, is in communication with the observers at Calama and is making studies of the relations of temperatures in Argentina to the values of the solar constant determined at Calama. Correlations as high as 68 per cent have been found between the two variables.

If temperatures at any station may eventually be predicted for some time in advance on the basis of measurements of the solar constant of radiation, a considerable number of solar radiation stations will be necessary in widely separated cloudless districts (C. G. Abbot: Work of the Smithsonian Astrophysical Observatory at Calama, Chile, *Monthly Weather Rev.*, Vol. 47, 1919, pp. 1-3). R. DeC. Ward

Increase of Precipitation on Mountains. Professor Alfred J. Henry, of the Weather Bureau, read a paper on "Increase of Precipitation With Altitude" before the Association of American Geographers at Baltimore, December 27, 1918, which has been printed in a recent number of the *Monthly Weather Review* (Vol. 47, 1919, pp. 33-41). Various factors control the relation between altitude and rainfall. When mountain systems are more or less parallel with the direction of the rain-bearing winds, there is little or no increase in precipitation. Other things being equal, the steeper the slope of the mountains, the greater the precipitation. The temperature and relative humidity of the air at the beginning of the ascent obviously determine to a large extent the quantity of rain or snow which falls, as does the duration of the rainy winds. The altitude of the zone of maximum rainfall seems to vary but little with latitude. It averages somewhat under 1,000 meters in the tropics and between about 1,400 and 1,500 meters in temperate latitudes. It is lowest in winter and highest in summer. R. DeC. Ward

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

SOUTH AMERICA

General

Nordenskiöld, Erland. **Om Indianernes Anvendelse af Gummi i Sydamerika. Et lille Bidrag til Gummiindustriens Historie.** Map, diagr. *Geografisk Tidskrift,* Vol. 24, 1917, No. 3, pp. 80-86. Copenhagen.

When Roosevelt made the famous journey recorded in his book "Through the Brazilian Wilderness" he was astonished to find the Indians "playing football with their heads," using a hollow rubber ball perhaps eight inches in diameter, which they butted back and forth with their heads. Dr. Erland Nordenskiöld, the Swedish explorer, has unearthed some tales of early travelers who record similar games. Thus Gumilla in the eighteenth century saw the Orinoco Indians playing with a ball made of a juice called *caucho,* and Oviedo in the sixteenth century found the natives of Hayti playing with balls which evidently were made of rubber. The curious feature of these games was that the ball must always be caught with the head, shoulder, hip, or knee, never with the hands.

The author himself has seen Indians in various parts of South America playing ball with their heads. In his "Indianlif" he tells a charming fairy tale of the Chané Indians. Aguaratunpa has caught a white condor, and the bird offers him a houseful of silver dishes in return for its freedom. Aguaratunpa scorns the offer but bids the condor bring him the white rubber ball "tóki." The bird does so and wins its freedom but manages to recapture the ball as it bounds back and forth between the heads of the players. So Aguaratunpa catches another bird and sends it out for the black rubber ball.

Nordenskiöld believes that the Indians invented the rubber syringe and that the tube was probably suggested to them when forming hollow balls around a lump of clay and washing out the soil afterwards. He thinks they used rubber for various other utensils, for dolls for their children, and for impregnating cloth. In fact, he comes to the conclusion that the entire civilized rubber manufacture is based on experiments carried out by the Indians before the advent of the white man. Hanna A. Larsen

Bailey, S. I. **Astronomical work in South America.** *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 12-16 (discussion, pp. 15-16). Washington, D. C., 1917.

Barclay, W. S. **The geography of South American railways.** Maps, diagr., ills. *Geogr. Journ.,* Vol. 49, 1917, No. 3, pp. 161-201; No. 4, pp. 241-282 (discussion, pp. 277-282). [Railroad development in South America is only beginning to assume international phases. Because of the local character of the systems, itself an aspect of "these curiously self-centered South American states," the systems of each state are considered separately.]

Bauer, L. A. **Status of magnetic surveys in South America by the Carnegie Institution of Washington.** Map. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 20-28 (discussion, pp. 26-28). Washington, D. C., 1917.

Coleman, A. P. **Permo-Carboniferous glacial deposits of South America.** Ills. *Journ. of Geol.,* Vol. 26, 1918, No. 4, pp. 310-324. ["Recent advances in the study of the South American Permo-Carboniferous glacial deposits bring that continent into the same rank as South Africa and Australia with respect to the area then covered by ice, while India has been much surpassed. The magnitude of the geological problem involved is growing from year to year, and the difficulty of accounting for such tremendous climatic changes is by no means lessening."]

Farabee, W. C. **The Arawaks of northern Brazil and southern British Guiana.** Ills. *Amer. Journ. of Phys. Anthropol.,* Vol. 1, 1918, No. 4, pp. 427-442. Washington, D. C.

Nordenskiöld, Erland. **Die Anpassung der Indianer an die Verhältnisse in den Überschwemmungsgebieten in Südamerika.** Maps, ill. *Ymer,* 1916, No. 2, pp. 138-155. Stockholm.

PARAGUAY, URUGUAY, ARGENTINA, CHILE

COOPER, J. M. **Analytical and critical bibliography of the tribes of Tierra del Fuego and adjacent territory.** ix and 233 pp.; map, bibliogr., index. *Bur. of Amer. Ethnology Bull. 63.* Smithsonian Institution, Washington, D. C., 1917.

Anthropogeographical literature is greatly enriched by the publication of this small book. The work falls naturally into several subdivisions. Pages 1-58 are taken up with valuable introductory remarks on the Yahgans, Alacalufs, Chonos, and Onas. The fullness of these remarks varies with the amount of available material, but in general their subject matter is grouped under headings: Names, Territory, Linguistics, Somatology, Culture, and Present Condition. Pages 59-64 are filled with an interesting review of the history, present status, and future of anthropological investigations in Fuegia. Pages 65-136 are occupied by a very extensive author bibliography in which every item enumerated is followed by critical remarks, often in the form of the contents of the work in question. Pages 137-228 contain an equally satisfactory subject bibliography which is incidentally a very full and stimulating outline of Fuegian somatology, linguistics, and culture.

One of the most important parts of Cooper's work is that which deals with the archeology and cultural relationships of the Fuegians, pages 218-228. This portion of the work is of value as showing that there are certain justificatory grounds for linking the Fuegians with the earliest peoples of South America and with the Lagoa Santa race. It remains to be seen to what degree this information will dovetail with that being gathered by Spinden and by the present reviewer on the archaic culture of Central and South America. In the meanwhile it is necessary merely to note that the Fuegians may turn out to be modern survivors of the archaic culture people on whom all later cultures in the region named succeeded. From the geographical standpoint this would be wholly natural, for it would be expected that the oldest, lowest-cultured, and weakest portion of the human race in Central and South America should be driven into the least desirable parts of the continent by succeeding waves of people. It is noteworthy that Cooper says (p. 219): "The length of occupancy of the archipelago is of course bound up with the larger question of the age of man in South America." He adds that it is evident that the present Fuegians have lived in their present habitat a very long time, a judgment which rests firmly on three aspects of the shell mounds which abound in Fuegia.

To sum up, one may say that Cooper's work is far more than a mere bibliography. It is a guide, full and scholarly, to the literature of Fuegian anthropology; it is an outline of the chief cultural features of the Fuegians; and it is a work which all future students of the subject will have to regard as their source book if they are not to go astray.

PHILIP AINSWORTH MEANS

—— **Comodoro Rivadavia petroleum deposits.** Ills. *Bull. Pan Amer. Union,* Vol. 48, 1919, No. 2, pp. 177-182. Washington, D. C. [From *La Época,* Buenos Aires. Spanish version also in *Bol. Unión Panamericana,* Vol. 48, 1919, No. 2, pp. 183-190.]

KEIDEL, JUAN. **Sobre la nieve penitente de los Andes argentinos.** 84 pp.; diagrs., ills., bibliogr. *Anal. Minist. de Agric.: Sección de Geol., Mineral. y Minería,* Vol. 12, No. 4. Direcc. Gen. de Minas, Geol. e Hidrol., Buenos Aires, 1918. [The author's study of these interesting forms (now known to be in no sense peculiar to the southern Andes) leads him to the conclusion that neither wind nor ice movement produces these *penitentes,* but that they are the result solely of radiation brought to bear upon the ice surface from different angles with the daily and seasonal change of position of the sun.]

LARROUY, P. A. **Los indios del Valle de Catamarca: Estudio histórico.** 58 pp. (Facultad de Filosofía y Letras, Publ. de la Sección Antropológica No. 14). Reprinted from *Rev. Univ. de Buenos Aires,* Vol. 27, 1914.

—— **Lluvias in 1916.** 43 pp.; diagr. *Inst. Meteorol. y Geofísico de Chile, Sección Lluvias Publ. No. 23.* Santiago de Chile, 1917. [Also contains summaries covering the years 1849-1916.]

MORANDI, LUIS. **Frecuencia, cantidad y modalidades de la lluvia y del granizo en Villa Colón (Montevideo) en el período 1884-1914.** Diagrs. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 225-234. Washington, D. C., 1917.

MORANDI, LUIS. **Síntesis general de los resultados obtenidos desde su fundación y en sus distintos secciones y servicios en el Instituto Nacional Físico-Climato-**

lógico del Uruguay. Maps, diagrs. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 779-824. Washington, D. C., 1917.

AFRICA

ATLAS REGION

PIQUET, VICTOR. **Le Maroc: Géographie—histoire—mise en valeur.** xii and 464 pp.; maps. Librairie Armand Colin, Paris, 1917. 6 fr. 8 x 5.

The splendid task of French colonization in Morocco is described in these pages. The author, already known by his historical studies of northwestern Africa, begins with an account of the region's geology based on the geological explorations of the past twenty years and in particular on the geological work of Louis Gentil. He then considers the climate and soil. These physical foundations having been laid, he proceeds with the history of the country, dwelling specially on the development of Moroccan affairs in the critical years between 1904 and 1912.

The book is valuable because of the comparison it affords between the condition of Morocco and its inhabitants before and after French intervention. Few chapters in the annals of French colonization deserve wider publicity than General Lyautey's work in Morocco. In presenting a concise summary of this task of reorganization the author has paid due acknowledgment to the ability of his countrymen in converting an important section of Africa from an unruly state into one in which justice now prevails.

The last pages contain a detailed account of the results obtained through the replacement of the Moroccan system of administration by French institutions. A feature that deserves commendation in the book is the comprehensive treatment of the subject, the author having succeeded in bringing together the main data on the geography, history, and economic development of Morocco.

—— **Yebala y el bajo Lucus: Expedición de Abril-Junio de 1913.** xxxviii and 320 pp.; maps, diagrs., ills. Real Soc. Española de Hist. Nat., Madrid, 1914. 4 pesetas. 8½ x 6.

An account of the lower Lucus region. The physical geography of the Spanish zone in Morocco is described in detail. The importance of these studies is best appreciated by students of the structure of the Mediterranean basin. As a contribution to our knowledge of the tectonic relations between Europe and Africa the work is also of great value. Geographers no less than geologists will feel indebted to the Real Sociedad Española de Historia Natural, under whose auspices the field work was undertaken.

The first part comprises daily accounts for the entire itinerary. This diary is followed by chapters on vegetation and fauna in which agriculture is also considered. A final chapter on ethnography adds greatly to the value of the report. The author explains in his preface that these are all non-technical descriptions and that full accounts of the work and collections will appear in time in the *Boletín* and *Memorias* of the Society.

AUBRY, ——. **L'élevage dans la région de Meknès.** *Bull. Soc. de Géogr. du Maroc,* Vol. 3, 1918, No. 5, pp. 39-54. Casablanca.

BEN DANOU, C. **Contribution à l'étude de l'industrie pastorale en Algérie et au Maroc. Note sur les laines du Sud Oranais et du Maroc.** With a preface by —— Toupnot. Diagr. *Bull. Trim. Soc. de Géogr. et d'Archéol. d'Oran,* Vol. 36, 1916, No. 3-4, pp. 293-340.

BEN DANOU FRÈRES. **L'avenir de l'élevage et du commerce d'exportation du mouton. Abatage sur place et frigorification.** *Bull. Trim. Soc. de Géogr. et d'Archéol. d'Oran,* Vol. 37, 1917, No. 2, pp. 175-202.

BERNARD, AUGUSTIN. **Nos grandes colonies et la guerre: Algérie.** *Rev. des Sci. Polit.,* Vol 36, 1916, August 15, pp. 1-29. Paris.

BERNARD, AUGUSTIN, AND EDMOND DOUTTÉ. **L'habitation rurale des indigènes de l'Algérie.** Map. *Ann. de Géogr.,* No. 141, Vol. 26, 1917, pp. 219-228.

BERNARD, FRANÇOIS. **Le Maroc économique et agricole.** 212 pp.; map. Georges Masson, Paris, 1917. 4 fr. 10 x 6½.

Bertrand, Gustave, and Étienne Delhomme. **Notice sur El Ksar El Kebir et la région du Khlott (Maroc franco-espagnol).** *Bull. Trim. Soc. de Géogr. et d'Archéol. d'Oran,* Vol. 37, 1917, No. 3-4, pp. 217-255.

Besnard, René. **Le rail dans l'Afrique du Nord.** Map. *Colonies et Marine,* Vol. 2, 1918, No. 7, pp. 162-185. Paris.

Campardou, J. **La grotte de Kifan bel Ghomari à Taza (Maroc).** Maps, ills. *Bull. Trim. Soc. de Géogr. et d'Archéol. d'Oran,* Vol. 37, 1917, No. 1, pp. 2-26.

Cereceda, J. D. **La zone espagnole du Maroc.** Diagrs., ills. *Ann. de Géogr.,* No. 137, Vol. 25, 1916, pp. 366-373. [Abstracted in the *Review,* Vol. 3, 1916, p. 402.]

Déchaud, E. **Une mission commerciale au Maroc.** *Bull. Trim. Soc. de Géogr. et d'Archéol. d'Oran,* Vol. 37, 1917, No. 1, pp. 27-102.

Demontès, Victor. **La Tunisie pendant la guerre.** *Bull. Soc. de Géogr. d'Alger et de l'Afrique du Nord,* Vol. 21, 1916, No. 1, pp. 26-76. Algiers.

Demontès, Victor. **Les lignites du Cap Bon.** Diagrs. *Bull. Soc. de Géogr. d'Alger et de l'Afrique du Nord,* Vol. 23, 1918, No. 2, pp. 151-198. Algiers.

Dupuy de Lôme, E., J. M. del Bosch, A. del Valle, and P. Fernandez Iruegas. **Estudios relativos á la geología de Marruecos.** Maps, diagrs., ills. *Bol. Inst. Geol. de España,* Vol. 38 (Vol. 18, 2nd Ser.), 1917, pp. 15-254. Madrid. [The introduction by D. Agustín Marín, chief of the Commission, outlines the plan of work—which follows the course of pacification—and gives a résumé of the geology, hydrology, and mineralogy of the zones subsequently treated in detail—Melilla, the Atlantic zone from Larache to Tangier, the Mediterranean zone from Ceuta to Tetuán.]

Fourgous, J. **Le Maroc et son avenir économique.** Map, diagrs., ills. *Bull. Soc. de Géogr. de Toulouse,* Vol. 35, 1916, No. 2, pp. 191-219.

Galinier, C. **Les Beni Mathar de Ras el Aïn (Berguent).** Maps. *Bull. Trim. Soc. de Géogr. et d'Archéol. d'Oran,* Vol. 37, 1917, No. 2, pp. 131-174.

Gardey, Abel. **Les ressources forestières du Maroc.** Map, ills. *Colonies et Marine,* Vol. 3, 1919, No. 1, pp. 33-40. Paris.

Gautier, E. F. **Le Chott Tigri.** Maps, ills. *Ann. de Géogr.,* No. 135, Vol. 25, 1916, pp. 181-189; No. 136, pp. 291-302.

Gentil, Louis. **Esquisse hydrologique de la région de Meknès.** *Bull. Soc. de Géogr. Commerc. de Paris,* Vol. 36, 1914, June, pp. 385-397.

Gentil, Louis. **Les analogies du Haut Atlas marocain et de l'Atlas saharien.** Reprint from *Comptes Rendus de l'Acad. des Sci.* [*de Paris*], Vol. 161, 1915, Aug. 2, pp. 103-105.

Gentil, Louis. **Sur la structure de la zone littorale de l'Algérie occidentale,** Reprint from *Comptes Rendus de l'Acad. des Sci.* [*de Paris*], Vol. 156, 1913, March 25, pp. 965-968.

Gentil, Louis. **Sur la tectonique du Haut Atlas marocain et ses relations avec l'Atlas saharien.** Reprint from *Comptes Rendus de l'Acad. des Sci.* [*de Paris*], Vol. 154, 1912, April 15, pp. 1011-1013.

Gentil, Louis. **Sur l'origine des plis de l'Atlas saharien.** Diagr. Reprint from *Comptes Rendus de l'Acad. des Sci.* [*de Paris*], Vol. 154, 1912, April 29, pp. 1191-1193.

Gentil, Louis, and L. Joleaud. **Les nappes de charriage de l'Afrique du Nord.** Map. *Rev. Gén. des Sci.,* Vol. 29, 1918, Oct. 15, pp. 533-540. [On the overthrust folds in the Atlas system.]

Gentil, Louis, and Pereira de Sousa. **Sur les effets au Maroc du grand tremblement de terre en Portugal (1755).** Reprint from *Comptes Rendus de l'Acad. des Sci.* [*de Paris*], Vol. 157, 1913, Nov. 3, pp. 805-807.

Joannis, R. **Excursion aux grottes de Moulaï Ahmed ou du Zegzel (Maroc oriental).** Map, diagrs. *Bull. Trim. Soc. de Géogr. et d'Archéol. d'Oran,* Vol. 36, 1916, No. 3-4, pp. 278-284.

Kœchlin, Raymond. **Le Maroc en paix: Un coup d'œil d'ensemble.** *L'Afrique Française,* Vol. 26, 1916, No. 10-12, pp. 355-367. Paris.

MacLeod, J. M. **The achievements of France in Morocco.** Maps, ills. *Geogr. Journ.,* Vol. 52, 1918, No. 2, pp. 84-105 (discussion, pp. 101-105).

—— **Maroc, Carnet des itinéraires principaux du.** Maps, indexes. Part I, **Partie nord,** 90 pp.; Part II, **Partie sud-ouest,** 127 pp.; Part III, **Partie orientale,** 72 pp. Bureau Topographique du Maroc, Casablanca, 1917. 2 fr. 50, 3 fr., 2 fr. 8 x 5½.

—— **Marruecos, La zona de influencia española en: Reseña geológica y descripción geográfica.** *Rev. de Geogr. Colon. y Mercantil,* Vol. 15, 1918, No. 4-5, pp. 121-161; No. 6-7, pp. 201-242. Real Soc. Geogr., Madrid. [A review of "Estudios Relativos á la Geología de Marruecos," by E. Dupuy de Lôme and others, listed above.]

MARUCCHI, ANTONIO. **La granicultura nei territori dell'antica Africa Romana.** *L'Africa Italiana,* Vol. 35, 1916, No. 8, pp. 153-172. Naples.

MILLET, PHILIPPE. **Problems of French North Africa.** *Journ. Royal Soc. of Arts,* No. 3368, Vol. 65, 1917, pp. 515-525. London. [Abstracted in the *Review,* Vol. 5, 1918, p. 76.]

MOUREY, CHARLES. **Le commerce du Protectorat français du Maroc de 1913 à 1915.** *Renseign. Colon. (Suppl. à l'Afrique Française),* 1917, No. 3, pp. 49-62. Paris.

NAVARRO, L. F. **Expedición científica á la Península Yebálica.** 27 pp.; map, ills. Asociación Española para el Progreso de las Ciencias, Madrid, [1913]. [Northwestern Morocco; an address delivered at Madrid June 20, 1913.]

NAVARRO, L. F. **Observaciones geológicas en la isla de Gomera (Canarias).** 87 pp.; map, diagrs., ills. *Trab. Museo Nacl. de Cienc. Nat., Ser. Geol. No. 23.* Madrid, 1918.

NOËL, A.-H. **Documents pour servir à l'histoire des Hamyan et de la région qu'ils occupent.** Maps. *Bull. Trim. Soc. de Géogr. et d'Archéol. d'Oran,* Vol. 35, 1915, No. 2, pp. 121-197; No. 3-4, pp. 249-303; Vol. 36, 1916, No. 1, pp. 5-60; No. 2, pp. 117-192.

PERROT, CHARLES. **Forêts de la région Ito, Ifrane, Azrou et Aïn-Leuh.** Ills. *Bull. Soc. de Géogr. du Maroc,* Vol 3, 1918, No. 5, pp. 55-68. Casablanca.

REBOUL, ANDRÉ. **L'Azaghar de Tiznit.** Maps. *La Géographie,* Vol. 32, 1918, No. 1, pp. 1-9. Paris. [A plain at the foot of the Anti-Atlas south of Agadir. The region is poor and scantily watered, but the geological structure permits a hope of obtaining abundant subterranean sources whereby irrigation could be practiced.]

S—, R. DE. **Le Sud Marocain.** *Renseign. Colon. (Suppl. à l'Afrique Française),* 1917, No. 5-6, pp. 130-137. Paris.

SALTER, J. H. **Regional distribution of the native flora in Teneriffe.** Ills., bibliogr. *Memoirs and Proc. Manchester Literary & Philos. Soc.,* Vol. 62, 1917-18, Part III, No. 8, pp. 1-16.

EAST AFRICA

DRACOPOLI, I. N. **Through Jubaland to the Lorian Swamp: An adventurous journey of exploration and sport in the unknown African forests and deserts of Jubaland to the unexplored Lorian Swamp.** 318 pp.; maps, ills., index. Seeley, Service & Co., Ltd., London, 1914. 10s. 6d. 9 x 6.

Jubaland is the northern region of British East Africa and the southern part of the still largely unknown country extending southward from Abyssinia. Dracopoli is the only explorer who has penetrated this part of Africa between 41°30′ E. and the Lorian Swamp. About two-thirds of his route survey from the Indian Ocean to the Lorian Swamp was thus through unknown country.

The explorer entered Jubaland at the port of Kismayu; his destination was the Lorian Swamp, about 300 miles inland, but his circuitous route added much to the length of his journey. Behind the coastal sands most of the country is covered with gray thorn bushes, difficult to travel through, interspersed with vast patches of reeds, 12 to 14 feet high, and occasional flat meadowland, green during the torrential rains. There are no mountains, rivers, or lakes; monotony is the keynote of the land. The scrub rising above the heads of the men completely obscures the view but is no protection against the burning sun. The ground is so hot at times as to be painful even through thick boots, and at the same time the humidity is great. Dracopoli regards the climate of Jubaland as distinctly unhealthful. Only three of his twenty-six men escaped attacks of malarial fever. The author calls this large region the East Africa desert jungle. Its only inhabitants are elephants, giraffes, dik-dik, a small variety of the antelope family, and birds. Along the western fourth of the journey, leading nearly to the mountains from which the Lorian Swamp derives its waters, the whole region is fairly well watered, and a considerable variety of African game is found.

The Somali live to the west of the desert region, along the upper Dera River, the outlet of the Lorian Swamp, and farther west, where there is forage for their cattle. No agriculture is found because the water supply, even there, is intermittent; and so the Somali wander from place to place seeking the best grazing and abundant water. More of them are moving into the country from the north. Perhaps the motive for this migration is to escape the troublous conditions that the remarkable régime of the Mad Mullah has imposed upon so much of Somaliland.

Dracopoli has cleared up the geography of the Lorian Swamp region, and this is one of his best geographical results. East of the Marti Plateau there are three slight depressions of the land through which the Uaso Nyiro flows, and a swamp occupies each depression. The central swamp is the Lorian, many times the largest, with a circumference of about fifty miles. The river flows in large volume through it, and its borders are banked by tall grasses and reeds. The land around the swamp is a rich alluvial plain that may easily be irrigated from the river. The author says that rice, cotton, and sugar would thrive well on this plain.

The book contains much scientific information and is also adapted to sustain the interest of any intelligent reader. Its map contains good material for the improvement of our atlases, including contours of elevation, along the route, at 100-foot intervals, showing the very gradual rise of the plain from sea level to 1,400 feet at the Marti Plateau in the west. CYRUS C. ADAMS

BRIEY, RENAUD DE. **Belgium and Germany in Africa.** Map, diagr., ills. *Geogr. Journ.*, Vol. 51, 1918, No. 5, pp. 293-306 (discussion, pp. 303-306). [In 1917 the Comte de Briey was sent on an official mission to German East Africa. He here gives notes on the western and northwestern portions of the country, i. e. along the central railroad and in Ruanda. Construction of the central railroad produced as powerful an economic effect on the country as the building of the Uganda Railroad did in British East Africa. This is shown in a graph. As soon as the railroad reached Tabora it began to exert a wide sphere of attraction, being very strongly felt in the Victoria Nyanza region. It is well known that the German economists aimed at tapping Katanga and in general making the Belgian Congo an economic hinterland of the German colony. *Le Mouvement Géographique* for June 7, 1914, published an interesting expression of this intention. Comte de Briey's article is accompanied by a hypsometrical map of the northwestern portion of German East Africa.]

CANA, F. R. **Frontiers of German East Africa.** Map. *Geogr. Journ.*, Vol. 47, 1916, No. 4, pp. 297-303.

GUIDI, IGNAZIO. **Le popolazioni delle colonie Italiane.** 14 pp. *Minist. delle Colonie Rapporti e Monografie Coloniali No. 10.* Direz. Centrale degli Affari Coloniali. Rome, 1913.

PALAZZO, L. **La distribuzione della forza magnetica terrestre nella media Eritrea.** Map. Reprint from *Rendiconti della R. Accad. dei Lincei: Classe di sci. fis., mat. e nat.*, Vol. 24, 1915, No. 1, pp. 48-54. Rome.

SHARPE, ALFRED. **Reconstruction in eastern Africa.** Map. *Scottish Geogr. Mag.*, Vol. 34, 1918, No. 7, pp. 241-251. [Suggests that the anomaly of separate administration for British East Africa and Uganda should be rectified. The suggestion is carried further in the proposal for centralizing authority here by the appointment of one Governor General for all British territory north of the Zambesi and south of the Sudan. Whatever the fate of German East Africa, certain rectifications of frontier are desired—certain sections of the northern part of the colony, including Ruanda, Kilimanjaro, and Usambara to the contiguous British areas, Kondeland in the south to Nyasaland. Problems in transportation, government, lands, and native questions, including labor, are also touched upon.]

SMUTS, J. C. **East Africa.** Map, ill. *Geogr. Journ.*, Vol. 51, 1918, No. 3, pp. 129-149 (discussion, pp. 145-149). [After describing the geographical features that loomed large in the East African campaign, General Smuts refers to certain considerations, economic and political, that affect the future of the country. He doubts whether East and Central Africa will ever become a white man's country in any real sense. Germany, however, has never encouraged any movement in this direction in her protectorate but has slighted the white settler with the small farm for the capitalist planter. The German theory of colonization, moreover, has its militaristic basis: this is revealed in the German schemes of a ''Mittelafrika.'' General Smuts's paper is fortunately illustrated by a hypsometric map showing the 200-meter contour and contours at 500-meter intervals. The same issue of the *Geographical Journal* also contains "Notes on the South-Western Area of 'German' East Africa" by Owen Letcher.]

Tobler-Wolff, Gertrud, and F. Tobler. **Vegetationsbilder vom Kilimandscharo.** 24 pp.; map, ills. (Vegetationsbilder, Ser. 12, No. 2-3. Herausgegeben von G. Karsten and H. Schenck.) Gustav Fischer, Jena, 1914.

Woodhouse, C. W. **Game and war.** Map. *Journ. East Africa and Uganda Nat. Hist. Soc.*, Vol. 5, 1916, No. 10, pp. 71-76. London. [The article deals with observations made in and prior to the war and during the first year of hostilities in British East Africa. The disturbance to local fauna has involved actual destruction and change in feeding grounds; but, with the probable exception of the rhinoceros, loss is believed to be merely temporary. Effect on migrations is well illustrated in the case of the elephant, which normally moves eastward from Kilimanjaro with the beginning of the long rains of spring. During 1914 the movement was as usual, but during 1915 only a few stray herds were reported in their usual habitats. The line of migrations is shown in a map accompanying the article.]

ASIA

Manchuria, Korea, Japan

Omori, F. **The Sakura-jima eruptions and earthquakes: Course of activity in the Sakura-jima eruption of 1914.** Maps, diagrs., ills. *Bull. Imp. Earthquake Investigation Committee*, Vol. 8, 1916, No. 3, pp. 181-321. Tokyo.

Besides the expectable features in this report there are several points of special interest. The sketches and maps are well made, many of the descriptions have broad physiographic interest, and the photographs are among the very best that have ever been published in the field of vulcanology. It would be difficult to find elsewhere photographs which could compare with Figure 35, showing a floating pumice layer outside the harbor of Kagoshima; or the admirable view, Figure 8, taken about one hour after the beginning of the eruption of Sakura-jima; or the phenomena exhibited by craterlets in Figures 86 and 91. Not the least striking is Figure 127, showing the vigorous evaporation of sea water at the edge of a broad and fresh lava flow.

—— **Chosen, Results of the meteorological observations made at, for the lustrum 1911-1915.** 27 pp. Meteorol. Observatory of the Government-General of Chosen, Jinsen (Chemulpo), 1917.

Hanabusa, Naosaburo. **Graphiques statistiques sur l'état de la population de l'Empire du Japon.** 25 pp.; maps, diagrs. Bur. de la Statistique Générale, Cabinet Impérial, Tokyo, 1916.

Hanabusa, Naosaburo. **Résumé statistique de l'Empire du Japon. Vol. 30.** xvi and 225 pp.; diagrs. Bur. de la Statistique Générale, Cabinet Impérial, Tokyo, 1916. 2.66 yen. 10 x 7.

Ishii, Shinji. **The island of Formosa and its primitive inhabitants.** Map, ills. *Trans. and Proc. Japan Soc.*, Vol. 14, 1915-16, pp. 38-60. London.

Kotô, Bundjirô. **The great eruption of Sakura-jima in 1914.** 237 pp.; maps, diagrs., ills., index. *Journ. College of Sci., Tokyo Imp. Univ.*, Vol. 38, 1916, Art. 3. Tokyo.

—— **Manchuria and Korea, The railways of.** Maps, ills. *Far Eastern Rev.*, Vol. 14, 1918, No. 4, pp. 143-153. Shanghai.

— **North Manchuria, New railways in: Russia consolidates her position.** Map, ills. *Far Eastern Rev.*, Vol. 12, 1916, No. 11, pp. 415-419. Shanghai. [For comment see note on "Proposed New Railroads in the Russian Empire" in the *Review*, Vol. 2, 1916, p. 472.]

Ōinouye, Y. **A few interesting phenomena on the eruption of Usu.** Map, diagrs., ills. *Journ. of Geol.*, Vol. 25, 1917, No. 3, pp. 258-288.

Simotomai, H[idezô]. **Der vulkanische Kessel Kutscharo.** Map. *Zeitschr. für Vulkanologie*, Vol. 2, 1916, No. 3, pp. 137-139. Berlin.

Simotomai, Hidezô. **Physiographic development of the Tarumai dome in Japan.** Maps, diagrs., ills., bibliogr. *Amer. Journ. of Sci.*, No. 260, Ser. 4, Vol. 44, 1917, pp. 87-97.

Simotomai, H[idezô]. **Vergleichende Übersicht der vulkanischen Tätigkeit der Fuji- und Kirishima-Vulkanzonen in Japan.** Map. *Zeitschr. für Vulkanologie*, Vol. 2, 1916, No. 3, pp. 129-137. Berlin.

Torii, R. **Études archéologiques et ethnologiques: Populations préhistoriques de la Mandchourie méridionale.** 80 pp.; map, diagrs., ills. *Journ. College of Sci., Tokyo Imp. Univ.*, Vol. 36, 1915, Art. 8. [From 1895 to 1913 the Anthropological Society of Tokyo carried out a series of five explorations in Manchuria and adjacent territories. The volume in hand pertains to the Liaotung Peninsula and the basin of the lower Liao River.]

Weston, Walter. **Exploration in the northern Japanese Alps.** Ills. *Geogr. Journ.*, Vol. 46, 1915, No. 3, pp. 188-200. [Read before the Royal Geographical Society, May 31, 1915. An abridgment, entitled "Recent Explorations in the Japanese Alps," was published in *Scottish Geogr. Mag.*, Vol. 32, 1916, No. 7, pp. 306-315. Under the first title a different paper (read before the Alpine Club, June 1, 1915) was published in *Alpine Journ.*, No. 213, Vol. 30, 1916, pp. 246-259.]

AUSTRALASIA AND OCEANIA

Australia, New Zealand

Mjöberg, Eric. **Bland vilda djur och folk i Australien.** 524 pp.; maps, ills., index. Albert Bonniers Förlag, Stockholm, 1915. 15 kroner. 9½ x 6½.

"Among Wild Animals and People in Australia" is the title of the present volume by the Swedish explorer, Eric Mjöberg. It is an account of his trip through the hitherto unexplored regions of the Kimberley District in Western Australia, in 1910 and 1911. Several large public and private stipends granted the author in his native land made it possible for him to carry a very complete outfit, and the loan of a large bullock wagon and span of twenty oxen by the Australian government facilitated the transport.

The journey into the interior began on October 26, 1910, from Derby on King Sound. After passing through a dreary stretch of bush, the party crossed the Grant Range and journeyed across a rocky plateau to Noonkanbah sheep station. At this little group of corrugated iron houses, the center of a flock of ten thousand sheep, Dr. Mjöberg unloaded his wagon and proceeded to make various excursions in the nearby mountains. Not far away lies Skeleton Hill, where the natives still "bury" their dead by tying the body to a bier of branches and placing it in a tree top. He succeeded in carrying away several complete skeletons and in taking numerous interesting photographs of this strange cemetery.

The study of the Australian aborigines is of especial importance, since they are a rapidly dying race. In spite of the efforts of the government, syphilis and tuberculosis work great havoc among them, and in a few generations they may have disappeared entirely. Peculiar interest attaches also to the flora and fauna of Australia. The continent has been called a great open-air museum for living antiquities. Scientists hold that, in the Cretaceous period, Asia was completely separated from Australia and that the latter pursued an independent development, which, however, lags far behind that of the rest of the world. Specimens from the Tertiary and even from the Cretaceous period are still extant. For instance, the pouched animal or marsupial was once prevalent all over the world, but in the other continents it has given place to more highly organized species. In Australia the marsupial may still be studied in all its variants, the most important being, of course, the kangaroo. On the other hand, the author calls attention to the fact that no important edible plant and no domestic animal in common use has originated in Australia. This he believes to be one reason for the low state of the Australian natives, who have never learned to harness nature. He declares that in many places they do not even know how to make the mental connection between plant and seed. Yet they seem in every way normal; their senses are highly developed, and they have originated the most curious of all weapons, the boomerang.

Dr. Mjöberg was himself in charge of the zoölogic and botanical researches of the expedition as well as the anthropologic and ethnographic, including the task of collecting skeletons. In his ethnographic investigations he was assisted by Mr. Yngve Laurell. His other two white companions were Mr. Rudolf Söderberg, the ornithologist of the expedition, and Mr. Cyrus Videll, who did the work of preservation. The results of the expedition included many thousands of specimens of vertebrate and invertebrate animals carefully preserved. A number of valuable photographs were taken. The book has two hundred and thirty illustrations, a few of these being in color.

Returning to Derby in April, 1911, the author afterwards spent some time in coast and marine investigations in Dampier Land before departing for Sweden.

Hanna Astrup Larsen

Reid, A. McI. **The North Pieman and Huskisson and Sterling Valley mining fields.** vi and 132 pp.; maps, diagrs., ills. *Geol. Survey of Tasmania Bull. No. 28.* Hobart, 1918. [Some twenty pages of this Bulletin are devoted to a geographical description of the area, one of the most rugged portions of the west coast division, concerning which no detailed account has hitherto been published.]

—— **South Australian Museum expedition to Strzelecki and Cooper Creeks, September and October, 1916, Results of the.** Maps, ills. E. R. Waite: **Introduction, Narrative, General notes, Meteorology,** pp. 405-424; H. A. Hunt: **Notes on the rainfall,** pp. 424-429; E. R. Waite: **The natives, Mammalia and Ophidia,** pp. 429-440; S. A. White: **Aves,** pp. 441-466; A. M. Lea: **Stomach contents of birds,** pp. 466-468; F. R. Zietz: **Lacertilia,** pp. 469-472; A. R. McCulloch and E. R. Waite: **Pisces,** pp. 472-475; Charles Chilton: **Crustacea,** pp. 475-482; W. J. Rainbow: **Araneidae,** pp. 482-489; A. M. Lea: **Insecta,** pp. 489-630; J. M. Black: **Botany,** pp. 631-658. *Trans. and Proc. Royal Soc. of South Australia,* Vol. 41, 1917, pp. 405-658. Adelaide. [Notes on the desert and semi-arid region east of Lake Eyre.]

Teale, E. O. **Soil survey and forest physiography of Kuitpo, South Australia.** 19 pp.; maps, diagrs. *Univ. of Adelaide Dept. of Forestry Bull. No. 6.* Adelaide, 1918.

White, S. A. **Scientific notes on an expedition into the northwestern regions of South Australia.** Maps, ills. *Trans. and Proc. Royal Soc. of South Australia,* Vol. 39, 1915, pp. 707-842. Adelaide. [In the capacity of biologist the author accompanied the reconnaissance expedition of 1914 organized by the Geological Survey of South Australia. This expedition was noted in the Record item "A Proposed Expansion of the Pastoral Industry of South Australia," *Geogr. Rev.,* Vol. 1, 1916, p. 377.]

White, S. A. **The flora of the country between Oodnadatta and the Musgrave and Everard Ranges.** *Geol. Survey of South Australia Bull. No. 5,* pp. 55-57. Adelaide, 1915.

Woodward, H. P. **The coal resources of Western Australia.** Maps. *Geol. Survey of Western Australia Bull. No. 64,* pp. 7-12. Perth, 1915. ["Written for the International Geological Congress, Canada, 1913."]

Woolnough, W. G. **The physiographic significance of laterite in Western Australia.** Map, diagr. *Geol. Mag.,* Decade 6, Vol. 5, 1918, No. 9, pp. 385-393. London.

—— ***Australia, Rain map of, for the year 1917.*** [1:8,500,000 approx.] On reverse side: maps, 1:32,000,000, showing the rainfall for each month during 1917. (The figures are based on the daily reporting stations and are therefore only approximate.) [Central Weather Bureau], Melbourne, 1918. [For additional comment see Record item "Rainfall Maps of Australia", *Geogr. Rev.,* Vol. 6, 1918, p. 373.]

Fox, H. W. ***Geological sketch map of Queensland, showing mineral localities.*** [1 in to 39 miles, or 1:2,500,000.] 3rd edit., revised to 1907. *Geol. Survey of Queensland Publ. No. 217.* Brisbane, 1907.

—— ***South Australia [showing land elevations.]*** [1:3,000,000.] Geological Survey, Adelaide, 1917.

OCEANS

Schott, G., B. Schultz, and P. Perlewitz. **Die Forschungsreise S. M. S. "Möwe" im Jahre 1911.** vi and 104 pp.; maps, diagrs., ill. *Aus dem Archiv der Deutschen Seewarte,* Vol. 37, 1914, No. 1. Hamburg.

This paper presents the physical observations obtained during the period from May to October, 1911, in a coastal belt 250 miles wide off the west coast of Africa from Cadiz, 35° N., to Cape Town, 33° S. Surface water samples were taken twice a day for accurate salinity determinations, and the usual meteorological observations and surface temperatures were taken every four hours. At 59 stations serial observations of temperature and salinity from the surface to the bottom were made, and the surface current was estimated from angular measurements relative to a float. At 30 stations the Ekman current meter was used at depths less than 100 meters. Careful determinations of the ship's position at noon from astronomical observations, and from the log and course, gave estimates of the current in fair agreement with the other method. In order to determine the variation of the biological facies of the bottom with respect to the varying physical conditions from shallow to deep water, samples were collected at each station. A limited amount of aerological work was done with the aid of kites and sounding balloons.

Three regions, the northern, middle or equatorial, and southern, corresponding respectively to the Canary, Guinea, and Benguela Currents, are discussed separately because of the great difference in their physical conditions. Serial observations of temperature and salinity were made along two sections perpendicular to the coast in the northern region and three in the southern one, and also along a longitudinal section of each region.

Because of the upwelling of cold bottom water, the northern region is characterized by an increase of temperature from the coast, where it is 1° C. below the normal, and a very small north-to-south temperature gradient. The air temperature is 1° C. above that of the water. Strong northwest winds (4 Beaufort), usually accompanied by a strong southerly surface current (0.5 to 1.5 miles per hour), prevail. The flow from the Mediterranean gives rise to high temperatures and salinities below 600 meters in the northern part. The salinity of the upper 50 meters increases as the distance from the coast increases.

In the middle or equatorial region high surface temperatures (25° C.) and an excess of water over air temperatures prevail, but water temperatures below 20° C. occur in a limited upwelling region near Lome only 7° from the equator. Along the part of the coast running east and west is a strong surface current (1 mile per hour) toward the northwest except near Lome, where it is parallel to the coast. Southwest winds (3 Beaufort) prevail.

The southern region is characterized by low surface temperatures, due to upwelling. The prevailing drift is to the northwest at the rate of 0.2 to 1.5 miles per hour, and the prevailing wind is from the southwest (4 Beaufort).

The observed change in direction and velocity with respect to depth accords qualitatively with Ekman's theory of currents due to wind. In general no marked divergence from former observations appears. GEORGE F. MCEWEN

HEPWORTH, M. W. C. **The relation between pressure, temperature, and air circulation over the South Atlantic Ocean.** 2nd edit. 14 pp.; maps, index. *M[eteorol]. O[ffice Publ. No]. 177.* Meteorological Office, London, 1917. 1s. 9½ x 6. [New edition of notes published in 1904, with pressure readings corrected for latitude in accord with international convention and expressed in millibars.]

MACGREGOR, WILLIAM. **The settlement of the Pacific.** *Scottish Geogr. Mag.*, Vol. 34, 1918, No. 5, pp. 161-177.

—— **Océan Indien l', Observations océanographiques et météorologiques dans; Septembre, Octobre, Novembre (1856-1914).** xi and 240 pp.; maps, diagrs. *Kon. Nederl. Meteorol. Inst. [Publ.] No. 104.* Utrecht, 1915. [With charts.]

RYDER, C. **Monthly mean temperatures of the surface water in the Atlantic, north of 50° N. lat.** 21 pp.; maps, diagrs. Appendix to the *Nautical Meteorological Annual*, Dansk Meteorol. Inst., Copenhagen, 1917. [The charts have been drawn upon the basis of observations from Danish vessels made during the years 1876-1915, supplemented by data from various published sources. An important feature is the division of the material into decades, whence, among other advantages, it will be the more readily adaptable for use in the study of climatic change.]

WORLD AS A WHOLE AND LARGER PARTS

HARING, C. H. **Trade and navigation between Spain and the Indies in the time of the Hapsburgs.** xxviii and 371 pp.; map, bibliogr., index. (Harvard Economic Studies, Vol. 19.) Harvard University Press, Cambridge, 1918. $2.25. 9 x 6.

For many years students of the colonization of the New World have felt the want for a book of just the kind that has been brought out by Professor Haring. It is almost impossible to understand the commercial features of the Spanish Conquest of the Americas without making laborious search throughout the records. This search frequently entails the consultation of hundreds of books and pamphlets. Thanks to the author of this volume, one now has a handbook on the subject which is not only authoritative but unique.

The volume is divided into two parts, the first part dealing with the trade created and the second part with the various matters pertaining to navigation of ships between Spain and the Americas. Step by step, the author traces the development of commerce, from the beginnings of the American trade until the institution of the Casa de Contratación. This powerful organization held approximately the same position in Spain as subsequently did the Dutch East India and the Dutch West India Companies in the Netherlands. The ordinances and royal decrees conferring various powers upon the

Casa de Contratación are traced in chronological order, as are the laws and judgments promulgated by the Council of the Indies. The regulations regarding the working of mines within the jurisdiction of the Spanish Crown in the West Indies and South America throw an interesting light upon the grasping policy of the Court. We find a lengthy and valuable discussion on the use of quicksilver in the extraction of silver, a process that was first discovered by a Mexican miner in 1556. Not only did the Crown derive its royal percentage of all silver mined, but it additionally declared the sale of quicksilver to be a royal monopoly, thereby creating two profits on all mining operations.

The second part of the book, on navigation, can unhesitatingly be said to contain the most exhaustive information on ships and their management in the sixteenth and seventeenth centuries of all monographs on the subject. This part discusses the kind of ships of that epoch, the various inspections and the regulations regarding the fitting out of craft designed for oversea traffic and even gives figures showing the pay received not only by the crew but by the higher officials appointed by the Crown. A noteworthy fact as giving an insight into the jealous care with which the Spanish sovereigns guarded their prerogatives was the appointment of a *veedor*, a sort of king's attorney, to each fleet leaving home waters, whose duties consisted in seeing that "all laws and ordinances regarding the management and governance of the fleet were observed, and that each man performed his duties, from the captain general down to the least of the commissioned officers. . . . He was at the general's side during the inspections and musters, a sort of royal watchdog for all occasions."

The organization of convoys for transmission of the wealth of the Indies to Spain is discussed at length, and the reasons for the easy capture of many of the more important South American and West Indian towns, such as Cartagena, Panama, and Havana, by pirates and freebooters, are explained. It is shown how the French, English, and Dutch privateers, the latter two named "Lutheran Corsairs" by their Spanish adversaries, were finally responsible for the collapse of the commercial edifice the Casa de Contratación had so carefully erected. That a great deal of this decline was directly due to a penurious policy of the home government, which would not devote sufficient funds for the fortification of its principal strongholds in the Americas, can be judged from the angry protests of the colonists, whose cities were often without the most elementary means of defending themselves against foreign invaders. As a result, the amount of tribute paid to besieging privateers by the more exposed cities amounted to incredible sums.

A very complete, classified bibliography is found at the beginning of the volume and is of high value to students of this epoch. Theodoor de Booy

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This paper epitomizes for the general reader the development of methods of observing oceanic circulation, the evolution of ideas thereof, and their relation to problems of meteorology. The first serious theory of oceanic circulation was formulated by Leonardo da Vinci in 1500. He wrote that the water of the torrid zone was reduced in density by the high temperature, thus giving rise to a deep undercurrent flowing from the poles to replace the surface water flowing out from the equator. In the seventeenth century, when the winds and ocean currents over most of the globe were known to some extent, it became apparent that the winds moved the surface waters of the oceans and were largely responsible for the ocean currents. By the early part of the nineteenth century much more accurate information concerning ocean currents was at hand, chiefly through Captain Cook's discoveries, the use of the chronometer (making possible the accurate location of vessels at sea), and the extensive employment of bottles. Franklin, in 1775, made the first temperature observations in the Gulf Stream and was the first to apply such observations to practical problems of navigation (cf. *Geogr. Rev.*, Vol. 4, 1917, p. 201, footnote). Humboldt, in 1814, published a detailed and accurate description of the currents in the North Atlantic. He appreciated the essentially variable character of ocean currents and, consequently, saw the need of continuous observations the year round. Following Rennell, who espoused the theory of the winds as the chief cause of oceanic circulation, and Arago, who first emphasized the importance of the deflective effect of the earth's rotation, Humboldt, in 1845, expressed his belief that several causes of ocean currents must be considered simultaneously. Maury, in 1850, held that the prevailing drift was the result of differences in density and that the motion thus produced might be modified by winds, rain, barometric pressure, and evaporation.

During the past few decades the application of the results of hydrodynamical laboratory observations and theories to explain the complex movements of ocean waters has largely failed to be conclusive. It is now generally admitted that ocean currents are due to various external forces—the wind or friction of a neighboring current, differences in pressure resulting from evaporation, precipitation, and differences in specific gravity—and are modified by the deflecting force due to the earth's rotation and by the internal friction of water. In studying an ocean current it is thus best to think of it as the sum of many components due to many different causes, both internal and external. The subject is so vast and complex that only through international co-operation can rapid advances be made.

The bearing of investigations of oceanic circulation upon seasonal weather forecasting has already been touched upon in the *Geographical Review*, and detailed discussion is to be found in the *Monthly Weather Review*, November, 1918 (pp. 510-512).

A useful bibliography on physical oceanography and the meteorological aspects of oceanography occupies the last two pages of this interesting historical sketch.

CHARLES F. BROOKS

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THE
GEOGRAPHICAL REVIEW

VOL. VIII AUGUST, 1919 No. 2

THE AWAKENING OF ALBANIA

By GEORGE P. SCRIVEN
Brigadier General, U. S. A.

It sometimes happens in the making of nations by decree, as appears to be the fashion in these days, that ideals and realities march side by side as they more often did in former and less complex times, when nations were born and not made. An instance of this stands out conspicuously among the peoples of today in the case of Albania, the almost unknown country of the Balkans that now asks recognition of its needs and claims. It is a small country, not important to the world as a state but vastly important to the peace of the family of nations; a country whose needs and desires go hand in hand with the history and geography and ethnology of its people, who for centuries have been the orphans of Europe, as homeless in the family of nations as the winds on their own mountain tops; a people without government, without ties, almost without friends, yet that from time immemorial have held fast to their motherland and their homes in spite of the seeming control of other nations. These are the Shkypetars, the "Men of the Mountain Eagle," of whom their great countryman, Ismail Kemal Bey,[1] says: "They have proudly preserved their independence, of which no power could deprive them. On the fall of the Roman Empire they reappeared on the world's stage to prove that they were of a race whose solidarity time could not affect and whose national genius custom could not prevent; today they display the singular and interesting spectacle of a nationality preserved pure and undefiled through the centuries in spite of so many successive conquests by Romans, Byzantines, Normans, Bulgarians, Serbs, Italians, and Turks."

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[1] An Albanian of Valona and chief of one of the oldest families in Albania. He was head of the provisional government in Albania when independence was declared in 1912. The quotation occurs in an article on "Albania and the Albanians" in the *Quarterly Review* (London), July, 1917, pp. 140-168.

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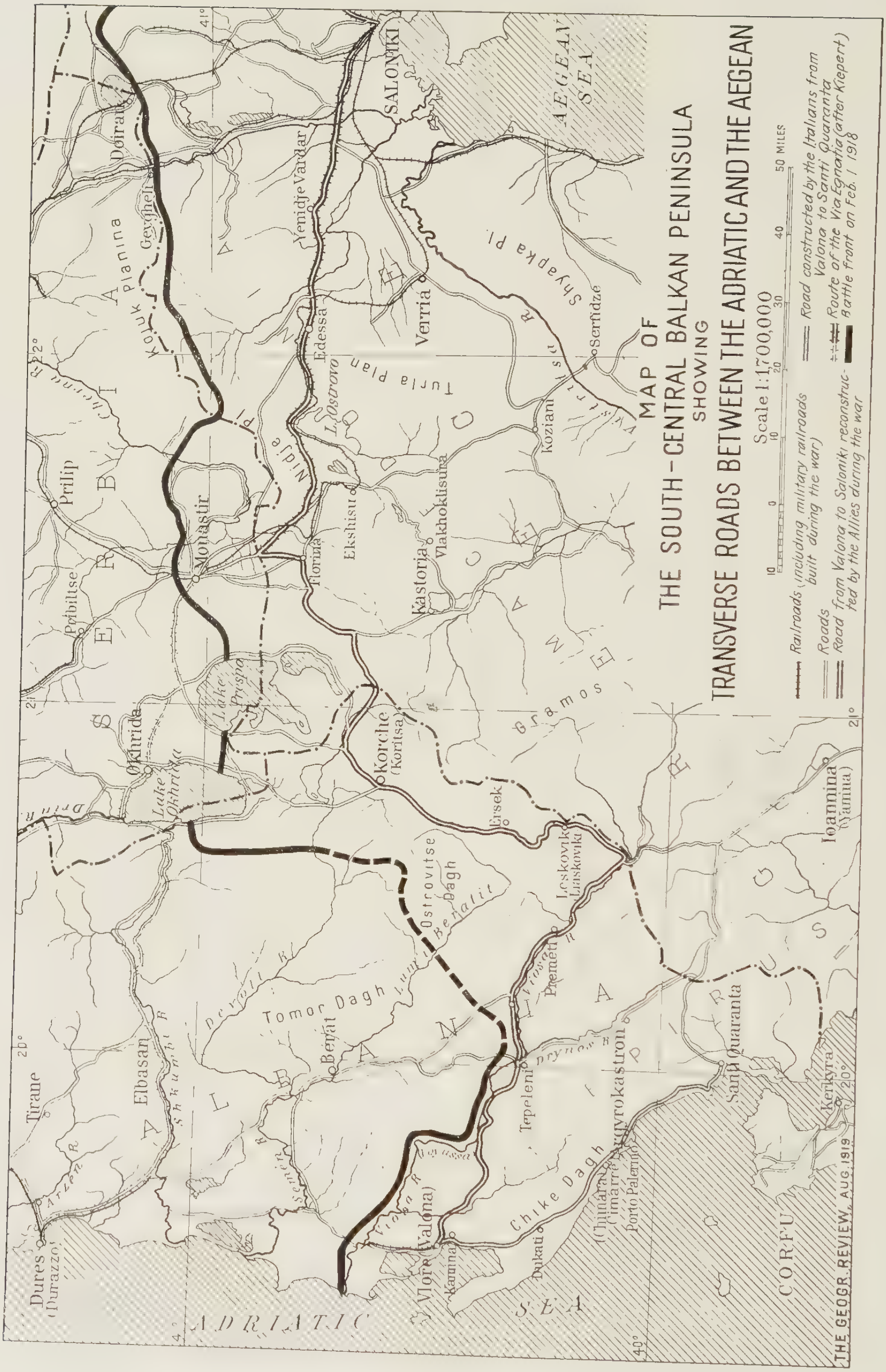
MAP OF
THE SOUTH-CENTRAL BALKAN PENINSULA
SHOWING
TRANSVERSE ROADS BETWEEN THE ADRIATIC AND THE AEGEAN
Scale 1:1,700,000
10 0 10 20 30 40 50 MILES
Railroads (including military railroads built during the war)
Roads
Road from Valona to Saloniki reconstructed by the Allies during the war
Road constructed by the Italians from Valona to Santi Quaranta
Route of the Via Egnatia (after Kiepert)
Battle front on Feb. 1 1918
THE GEOGR. REVIEW, AUG. 1919
SERBIA
MACEDONIA
ALBANIA
EPIRUS
ADRIATIC
SEA
AEGEAN SEA
CORFU
Saloniki
Doiran
Gevgheli
Kojuk Planina
Yenidje Vardar
Edessa
Verria
Shyapka Pl.
Serfidze
Turla Plan
Nidje Pl.
L. Ostrovo
Koziani
Prilip
Monastir
Florina
Ekshisu
Kastoria
Vlakhoklisura
Pribiltse
Okhrida
Lake Okhrida
Lake Prespa
Korche (Koritsa)
Ersek
Gramos
Leskovik (Liaskoviki)
Ostrovitse Dagh
Benalit
Premeti
Tomor Dagh
Berat
Elbasan
Tirane
Dures (Durazzo)
Vlore (Valona)
Kanina
Dukati
Chike Dagh
Tepeleni
Argyrokastron
(Chimara) (Cimarra)
Porto Palermo
Santi Quaranta
Ioannina (Yanina)
Kerkyra
Drin R.
Arzen R.
Shkumbi R.
Semeni R.
Devoli R.
Osum R.
Viosa R.
Drynos R.
Cherna R.
Vistritsa R.
41°
40°
20°
21°
22°

FIG. 1

The Albanians: Their Virtues and Their Faults

Of probably pre-Hellenic origin, the Albanians have remained as unmixed a race as any that exists in Europe. They are a people who possess in a high degree the basic virtues that make for stability and respect with nations as well as with men. Of them it may of a truth be said that they are courageous; honest and loyal to country, to family, and to the stranger that is accepted within their gates; they honor their women and their homes and, if bitter in enmity, are faithful in friendship; even the vendetta, of which they are accused, has its honorable side, for they fight openly without treachery. Their very faults are those of a proud people who have inherited a beautiful land coveted since history began by powerful neighbors against whom they have always been compelled to fight. What wonder, then, that the troubled and isolated lives of these mountaineers and their age-long struggle for freedom have rendered them restive under control and interference, intolerant of strangers, and indifferent to an outer world which tradition and history tell them is their enemy or at best a self-seeking friend? Their faults, such as they are, mark a phase in the evolution of a strong people; and through such phases have passed, not so far back in history, some of the best of the world's nations. In the future no doubt others will so pass to take their place in the family of nations. Why not the Albanians? For them the hour has struck; freedom from the smothering rule of the decadent Turk and the light let in by the great torch of war have awakened the minds of the people, quickened their energies, and shown them the need of nationality, unity, and intercourse, without which their country will remain a cancer in the Balkans and a source of infection to all Europe.

These things Albania should have; she deserves a better fate than to be left longer to the contempt and neglect that have nearly always been her lot. For Albania is a country as beautiful as fairyland and as rich as the fabled realms of Prester John, but it is as unknown as the heart of Africa and as ill defined.

Extent and Boundaries of Albania

To the people of the West, Albania is a word, a geographical expression indicated on the map as an ill-defined region of the eastern Adriatic, lying north of Greece, south of the Serbs, within the former Austrian sphere of influence, and extending inland over a chaos of mountains to the limits of heterogeneous Macedonia. It is seen as a sparsely settled country of hills and valleys, of rivers and lakes; but of its fertility and charm, of its people and their manner of life, little has been told except in recondite works on its history, its language, and the origin of its people. These works, for the most part treating of the days before Albania had thrown off the stagnant rule of the Turk and before war had brought in the soldier of the occupation, though interesting as studies, throw little light upon the

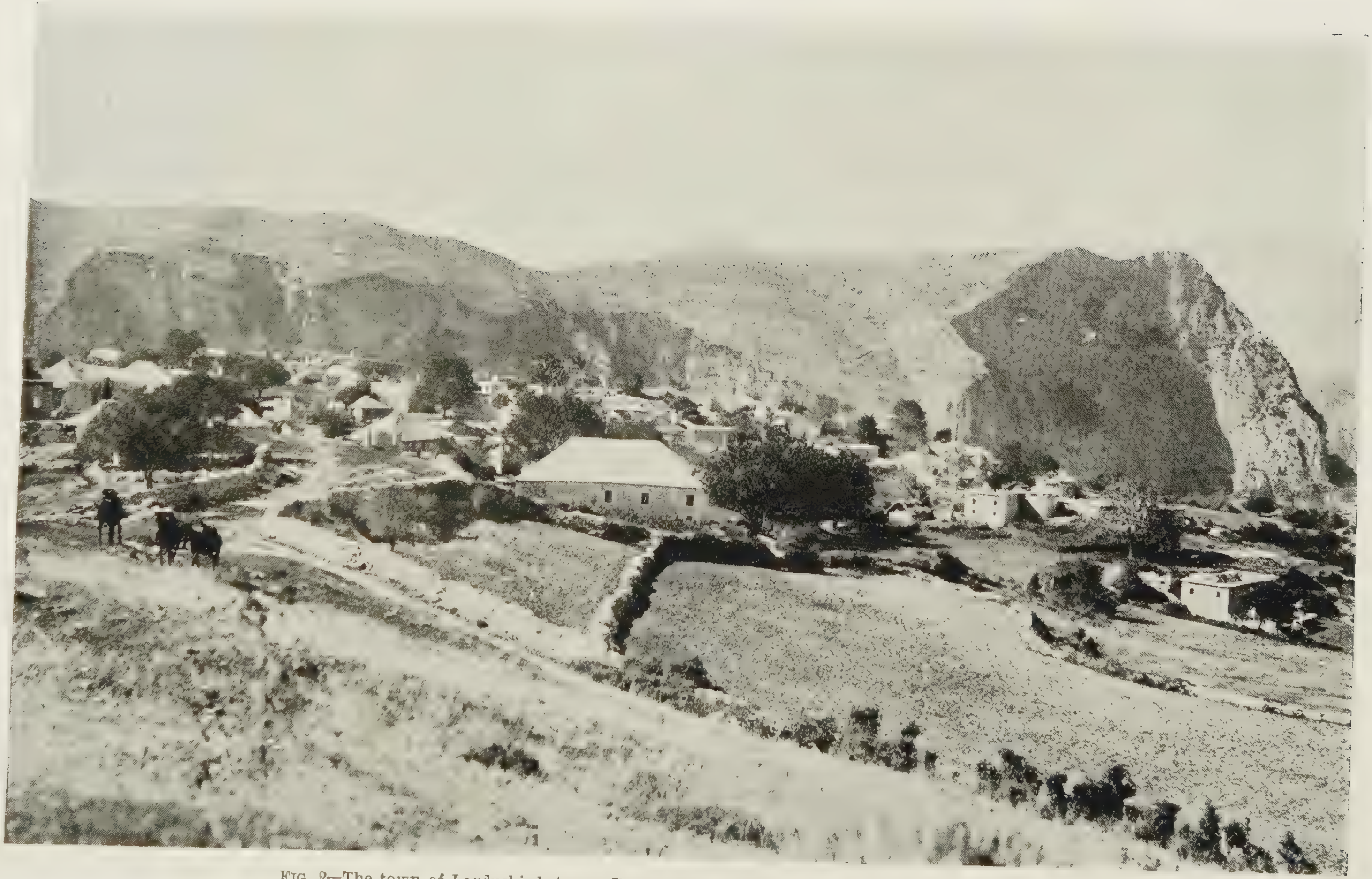

FIG. 2—The town of Legdushi, between Tepeleni and Porto Palermo: a typical scene in Epirus.

Albanian of today or upon the problems that now confront the people. The first of these problems is the extent of their own country, which has existed without boundaries, or with boundaries so ill defined that no man needed to recognize them until they were outlined by the London Conference of 1913. This conference, according to Albanian authority, "gave to Albania a territory of about 11,000 square miles, while more than one-third of her population and territory was given away to Serbia, Montenegro, and Greece. But at the present time supreme efforts are being made by the Albanian government, nobly supported and seconded by the United States, to recover the lost territories; and it is hoped that the Albania of the future will have an area of about 20,000 square miles with a population of about 2,500,000."[2]

That these efforts are reasonable is evident from an official statement of a representative of England[3] made to his government some thirty years ago to the effect that "the district covered by the geographical expression [Albania] falls mainly within the two vilayets of Scutari and Janina but extends also in an easterly direction, beyond the watersheds of the mountains dividing the streams which fall into the Adriatic from those which fall into the Aegean Sea, and includes portions of the vilayets of Bistolia, or Monastir, and of the vilayets of Pristina, or Kossovo."

The Migrations of the People

But, whatever may be the extent of the real Albania or the boundaries accepted by the Paris Conference or by a future League of Nations, the region thus delimited will never outline all the country occupied by the Albanian people. For they, like other races, have wandered from their rugged mountains into less difficult lands. To the east they have mingled with the confused mass of people who make up Macedonia; to the south they have sought the sunny lands of Greece; and westward they have traversed the narrow waters of the Adriatic and occupied by scores of thousands the valleys of Italy and Sicily. Indeed some sixty thousand of them are now with us in the United States. But in all their wanderings it is certain that these people have preserved the fundamental qualities of their race and have remained the "Men of the Mountain Eagle" whom not even the Roman could bend wholly to his yoke.

Roman Relics and Traditions

The wanderings of these people began no doubt long before the galleys of old Rome visited the bays and inlets of the eastern Adriatic or her soldiers marched over the Via Egnatia. Along the coast, on the road, for instance, whose traces are still found near Porto Palermo, relics of Roman influence exist—a bridge here, a burial place there, or, most striking of

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[2] From a letter of Mr. Constantine A. Chekrezi, representative in the United States of the Albanian federation Vatra.

[3] Lord Fitzmaurice, May, 1880.

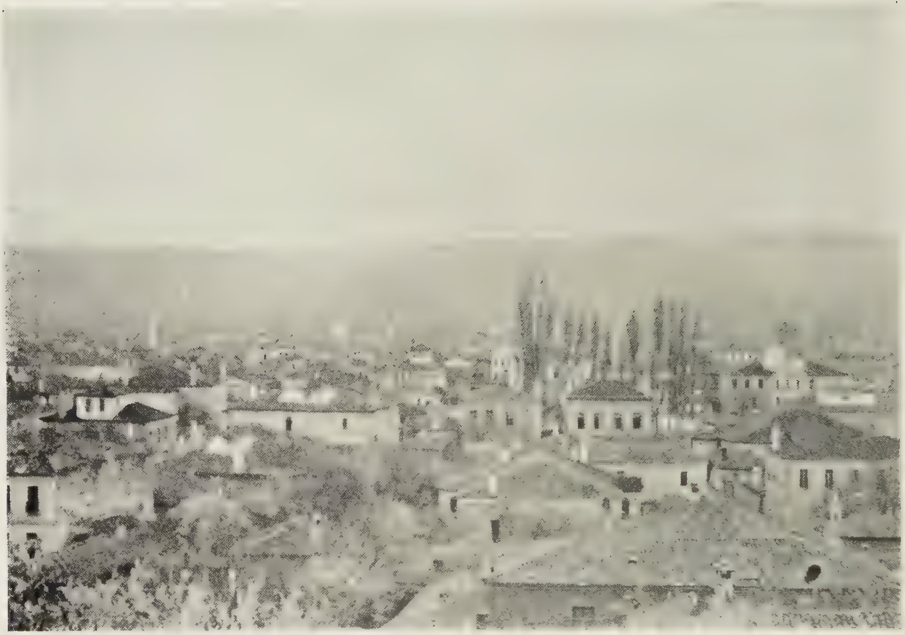

Fig. 3

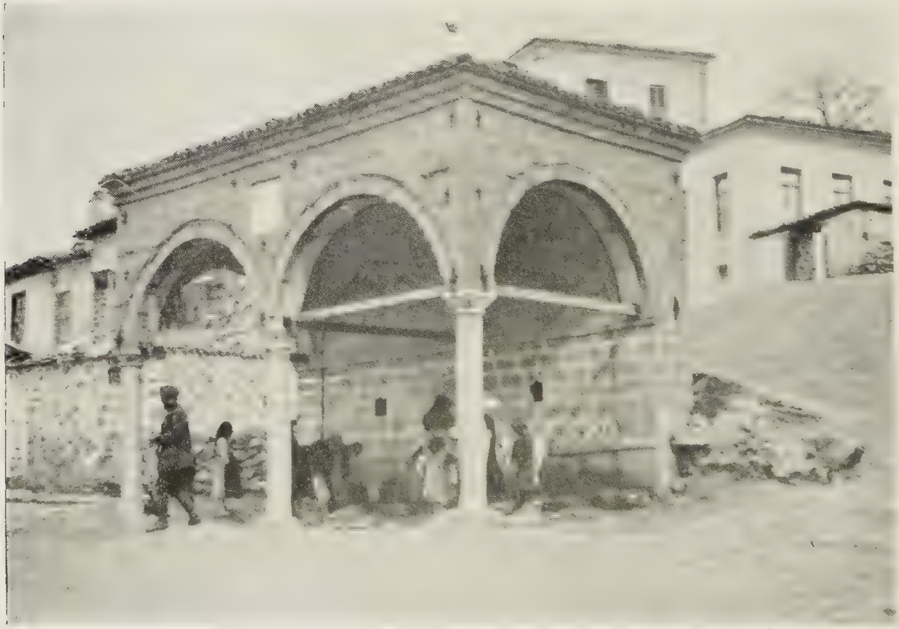

Fig. 4

Fig. 3—General view of Koritsa (Korche).
Fig. 4—A public well in Koritsa.

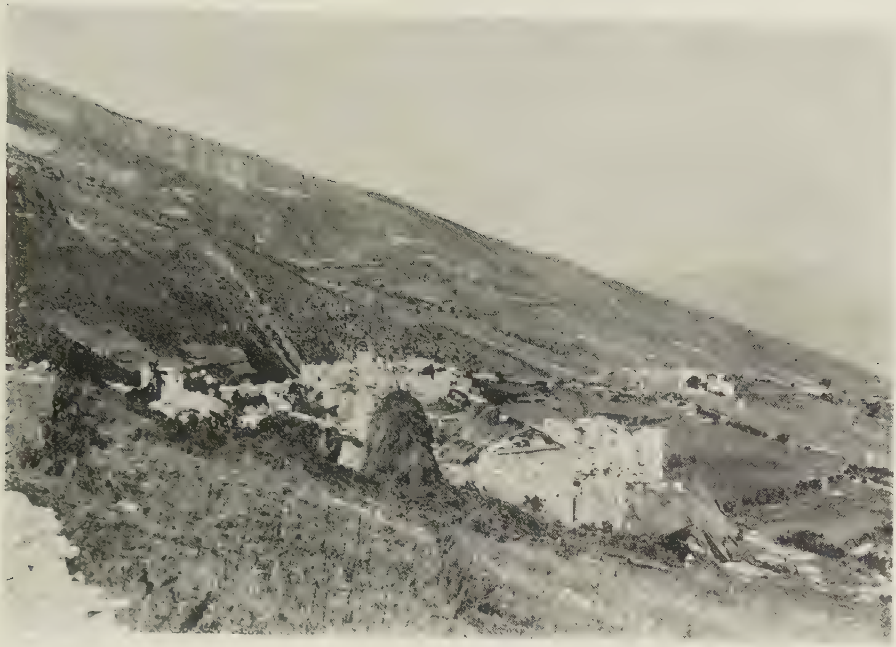

FIG. 5

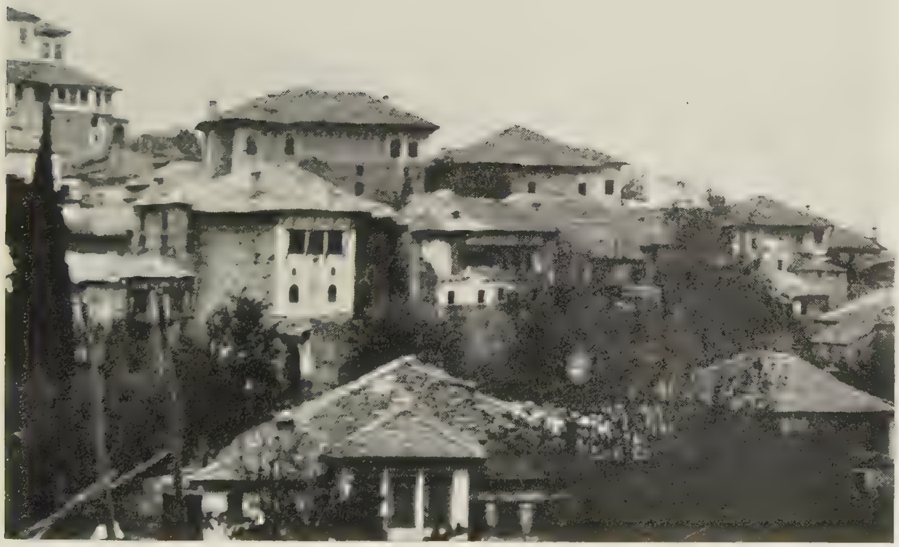

FIG. 6

FIG. 5—Saliari, an Epirote hamlet.

FIG. 6—Part of Argyrokastron. The town is built on a hillside overlooking the Drynos valley.

all, the descendants of the men of the broken legion who still wander over the Albanian hills feeding their flocks in the valleys in winter or on the high hill slopes when summer comes. These are the pastoral Rumeni, who proudly reply when questioned: "I am of Rome." Of their origin they sing:

O ye, who know it well,
Who know us full well,
O ye flowery valleys,
Ye lofty mountains, speak,
Talk to the people;
Relate to us, pray,
From what country we came,
O'er what roads we traveled
To thee, O Pindus;
For the world is not yet
Conscious of us and does not know
All the truth.

Ye have come here from Rome
And have grown up here;
Remote was the time—
It is known to me only;
I saw ye when small
And know well ye are Latins,
And it is your language
(Which recalls Rome to me)
That I talk with the birds
Of the Apennines and with those
Who build their nests
Among my ferns and have
So sweet a song
That it melts all hearts.

MONUMENTS AND RUINS

To Venice, however, rather than to Rome, Albania of the Adriatic owes the best of its monuments. Graceful bridges still span the rivers, magnificent olive groves rise on many a hill, and a score of imposing castles of stone dot coast and hillside. Above Valona stand the grand ruins of Kanina. But these ruins are even surpassed by the remains of the giant castle of Argyrokastron which once dominated that quaint Old World town and the neighboring valley of the charming Drynos. At Porto Palermo the well-preserved works, half castle, half fort, still served in the war as a defense against the submarine; while at Vuno the Lion of St. Mark, rudely carved in the living rock, marks the love of the people of the city by the sea for this charming coast of the Adriatic. But there are other and far different ruins to be found in southern Albania, scores, perhaps hundreds of destroyed villages cover its hills; myriads of gray stone houses, once the homes of peasants, stand deserted by all but the storks; fertile fields remain untilled; mosque and minaret and church are broken ruins, and desolation broods over many a lovely scene.

But space is lacking here to tell of these things; of destroyed Liaskoviki; of ruined Dukati; of the relics of historic Tepeleni, lying between the rivers in front of the gorge of Klisura where the Roman once checked the barbarian advance. Nor can the pathetic ruins of the castle of the mighty Albanian, Ali Bey, be described here—a castle destroyed like others in the strife that followed the Balkan wars. Let the Albanian himself tell the story, and let the Greek listen to the Albanian's tale.

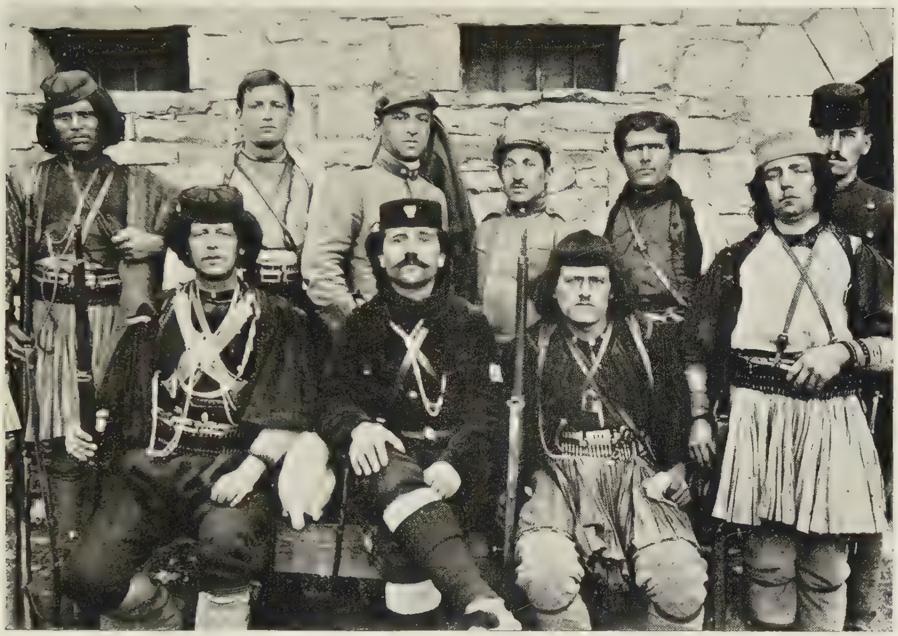

Fig. 7—Albanian irregular troops commanded by Italian officers.

Effects of Turkish Rule

Of the Turk and his rule few monuments remain. Except in the matter of religion and obstructions to education and progress, he left but slight impression upon Albania. There is little to recall his centuries of government beyond a few unspeakable roads, unlovely buildings, and crumbling tombs.[4] In spite, however, of the traces of Rome that still exist in Albania, it is probable that no great impression was made by the people of the "boot of Europe" until the great emigration of Albanians into Italy after the battle of Kossovo, toward the end of the fifteenth century, when Greek, Bulgar, and Serb went down before the Turk, as well as the Albanian clans led by their hero Skanderbeg. Then it was that a further union of the Pelasgic tribes became impossible. A good portion of them became converted to Mohammedanism; others took refuge in Italy; still others kept their religion and became subject to the Turk in appearance only.[5] Those who emigrated into Italy scattered; they adopted the language, customs, and dress of the new land in which they lived, but they never gave up their old country. In Calabria, in the Basilicata, and in Sicily live a hundred thousand of these people in scattered communities, distinct in race and language.[6] Among them is the Crispi family, from whom came the great statesman of Italy of twenty-five years ago.

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[4] Ismail Kemal Bey, in speaking of Turkish influence, says: "In spite of the religious and other consequences of the Turkish domination, the Albanians have remained faithful to the customs and habits of their ancestors. Indeed, under the Turk the Albanian preserved many of his privileges and continued a semi-independence under his own chiefs."

Italian Influence

The influence of the Albanian immigration into Italy was considerable, especially upon the coast towns of the Adriatic and upon Valona, where Catholic Italians of Albanian origin gained considerable influence. This is an important fact to remember in studying the relations between Italy and Albania and the conflict between Italian and former Austrian interests centering at Valona. At the outbreak of the war Italy's chief interest in Albania lay in Valona both on account of the fact that a large number of representatives from her Albanian immigrants had returned to settle there and on account of the importance which she then—as now—attached to this great harbor lying in the Straits of Otranto. There were Italian colonies and traders at Durazzo and Skutari; but, in spite of the work of the Franciscans and of the Austrian and Italian schools founded for religious purposes, which used the language employed by the Jesuits for all Albanian church literature (Latin with four additional letters and Italian spelling), it does not seem probable that, behind the coast line, Italian influence was considerable. The Turks prohibited schools in the national language.

Effect of the War

Great has been the change in Albania brought about by the war. To the soldiers of Italy, France, and England, the writer believes, is due a great uplift in all the Balkan countries, and to the Italians especially the awakening of southern Albania from its sleep of centuries. Here Italian influence was at its height, and from here it will spread throughout the mountain lands. From here also first came the check to the German threat against the southern Adriatic. Had this advance not been checked in the early days of the war, it would have carried the hordes serving with the Austrian flag, as well as the Bulgars and possibly the Turks, far down into Epirus and into wavering Greece and would perhaps have made it impossible for the Allies to throw across the Balkans from Valona to the Aegean

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[5] Frassari Adamidi: Les Pélasges et leurs descendants, *Bull. de l'Inst. Egyptien* (Cairo), Series 4, No. 3, 1902, pp. 5-15 and 45-57.

[6] See Alessandro Smilari: Gli Albanesi d'Italia: Loro costumi e poesie popolari, Naples, 1891.

Sea the armed wall from which fell the blow that at last broke down the German arch.

Of Italy's part in the war there is no occasion to speak at length here. It is enough to say that before the experimental Wied was called to his impossible task the Albanian stood at bay, exhausted by his struggle in the earlier wars, surrounded by a pack of hungry neighbors, and alone in his troubles. Then came the German war and with it the protecting arm of Italy. On Christmas day of 1914 the Tenth Regiment of the Bersaglieri landed at Valona, and the Italian soldiers advanced by stages to a junction with the French left flank at Ersek and brought Albania, from the Voyussa River to the Greek boundaries and from the Adriatic to the French sphere of influence, under their control. Then indeed the burdens of the Albanian of the south were lightened, and hope awakened. The Italians, under General Ferraro, brought them peace in the midst of war. He fed the starving people, gave them money for improving their lands, and built docks and roads such as Albania had not seen since the days of ancient Rome. Hospitals for the people were opened, schoolhouses were built, mail and telegraph service was instituted, and experimental farms were established. Not content with material assistance, the Italian soldier established courts where the Albanian, whether Moslem or Orthodox, was judged as an Albanian. Sanitation was looked to; religious beliefs were respected, the vendetta was abolished (or at least held in abeyance), and the peasants were disarmed. All this was done in the midst of war.

THE FUTURE

The time has come when Albania should be given a government and a place under such mandatary at first as shall be needed. She should then have the chance to develop her proper character—that of the Switzerland of southern Europe, in some respects, indeed, a more beautiful Switzerland than that of the northern Alps.

Let the Albanians of Albania decide their own future, for it is their right. Whatever may have been the changes wrought in the fringes of the country by the surrounding peoples during the course of two thousand years, the Albanians have remained a family bound by the unchangeable conditions that surround them and by the compelling facts of life. True, they are not and never have been a united family and have been forever embroiled by matters of leadership, of religion, and of policy; but their dissensions will pass away with time and growth as they have passed away in the case of other mountain peoples who have suffered from the same complaints in childhood as the Albanians. Like the Swiss, the Albanian is possessed of those fundamental virtues which, when the time comes, will surely give him his place in the family of nations to the great benefit of Europe and of the world. It is for Paris, or perhaps later for Geneva, to say when that time shall be; but come it must if the Balkans are to have rest.

THE SETTLEMENT OF TROPICAL AUSTRALIA

By GRIFFITH TAYLOR
Commonwealth of Australia Bureau of Meteorology

In the past twenty-five years man has rapidly extended his dominion over three great pioneering belts. The desert has been conquered to an extraordinary degree by the engineer and the farmer, the tropical forest has been invaded by the white settler, and the subarctic belts have seen a great increase in the number and size of permanent habitations. These conquests are in part the result of discoveries in the field of science, but in large part also they represent a changed mental attitude toward new or strange ways of life. Explorers who returned from the Arctic were expected to relate stories of intense cold and suffering. Was not the man who had lived in the tropics bound to be pale and weak from fever? The desert traveler had to have his tale of thirst. Men have always dramatized their adventures in exploration.

With every change in mental outlook and every great advance in science man does well to appraise his difficulties and opportunities anew. It is a service to mankind to offer fresh outlets for his energy and his spirit of enterprise and at the same time relieve that pressure for land and resources that impels him at times to make war as a supposed alternative to internal disorder or decay. An excellent study of Australia has just appeared and is of such outstanding importance that it is in part published below. It has been compressed into the space of an article by the editors, who are also responsible for the form in which it is published. It sets forth with great force and precision the problems of a large and thinly populated tropical region and is one of the best studies of its kind ever attempted.*

The Problem Stated

To the politician who makes a flying visit to tropical Australia in the most favorable time of year there appears to be ''no reason why a thriving white population should not fill the tropical areas.'' The government official, usually engaged in promoting some branch of industry, has his accounts buried beneath a mass of advertising literature. It is useless to consult the bushman living wholly out of doors and following the most healthful occupation in the world; his opinion is valuable only as regards the conditions of pastoral life. In view of these difficulties it might not be amiss to study the facts comparatively and in a scientific spirit. What is tropical Australia? Will it support a large white population? What are the experiences of whites in similar climates elsewhere?

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*Griffith Taylor: Geographical Factors Controlling the Settlement of Tropical Australia, *Queensland Geogr. Journ.*, Vols. 32-33, 1918, p. 1-67.

Political Divisions of Tropical Australia

Tropical Australia is divided, politically, among the three divisions of Queensland, the Northern Territory, and West Australia and constitutes 38.6 per cent of the area of the Commonwealth.[1]

The population, exclusive of aborigines, is distributed as follows: In Queensland there is a large tropical population of 160,000 persons, constituting 95 per cent of the whole tropical population and forming an important portion of the total for the state. In the Northern Territory 90 per cent of its small population, or 3,500 persons, are congregated in the warmer regions and hardly any in the relatively cooler inland areas. In West Australia less than 2 per cent, or 5,000 persons, are found in the enormous tropical areas.

A consideration of the reasons for these differences—which are natural and in accord with the logical principles governing the spread of population—will be found to give the key to the problem confronting us.

Elevation of Australia

Of all the six continents Australia has, by far, the lowest average elevation. Antarctica is largely a plateau over 7,000 feet high. Asia has her great Tibetan Plateau, and all the warmer regions belong almost generally to the highlands. America has an immense belt of great width running down the western side of the continent; while Africa, south of the equator, is almost wholly over 3,000 feet. The northern portion is, to be sure, somewhat low, and in many ways this northern African region offers the closest parallel to tropical Australia. Speaking generally, it is advantageous that temperate regions are low and tropical regions high. Australia, unfortunately, exhibits its chief highlands in the cooler regions—while the tropical portion is almost wholly below 2,000 feet.

The Topography of Tropical Australia

The Coast Lands

The topography of northern Australia (Figs. 1 and 2) includes a narrow belt of coast land, crossed here and there by streams of varying size, which, in the southwest, are mere chains of water holes except in the wet season. Around the Gulf of Carpentaria the lowlands have their maximum width of about one hundred miles. They are here crossed by a number of large rivers, one of which, the Roper River, is navigable for ninety miles by vessels drawing fourteen feet. There is a close relation between large rivers, wide lowlands, and heavier rainfall. The scenic aspect of the lowlands varies not only with their width and the relief of the country behind them but also with the vegetation. The shore is fringed by mangrove and ti-tree thickets. In the southwest there is desert country back of the shore, with patches of desert scrub as the only vegetation. Where the rainfall is greater there are grassy prairies, and toward the north-northeast, as about Port Darwin and along the eastern coast of Queensland, there are open eucalyptus, pine, and gum forests.

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[1] Australia, including Tasmania, has an area of 2,974,586 square miles. It constitutes about one quarter of the British Empire and is nearly twenty-five times as large as the United Kingdom. It is this great size, taken together with the fact of the limited population (4,940,952 in 1914), that gives to the problems of Australian development their unique character.

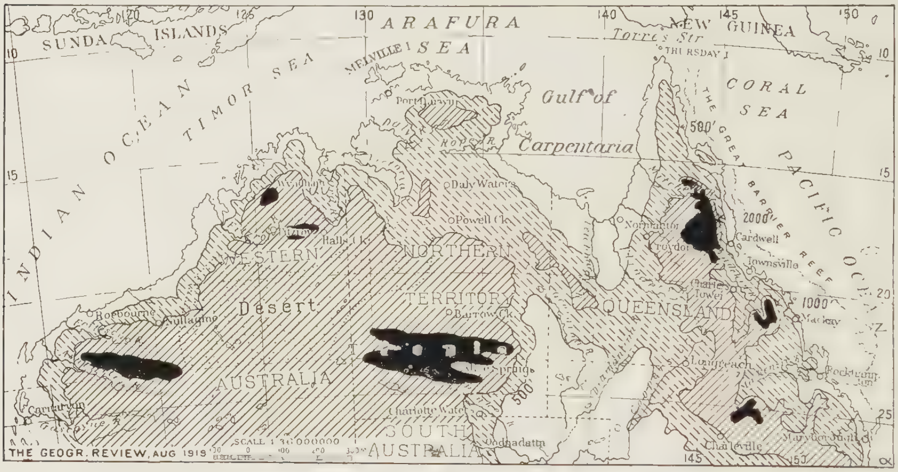

FIG. 1—Topography of tropical Australia. Black areas, over 2,000 feet; ruled, over 1,000 feet; broken, over 500 feet. (All the maps and diagrams are copied from the author's paper. In the case of several, slight modifications have been made in contours, isotherms, isohyets, etc., according to the author's more recent "Atlas of Contour and Rainfall Maps of Australia," reprinted from *Commonwealth Advisory Council of Science and Industry Memoir 1*, Melbourne, 1918.)

THE INLAND TOPOGRAPHY

Inland from the coastal lowlands the country has a somewhat more complex topography. In general, the region may be described as a peneplane which stands at an elevation of 500 to 1,000 feet above the sea, with small areas of higher extent, some of which are residual in character. Hardly anywhere in Australia are there mountain ranges in the true sense of the word. The continent has been free from any marked buckling of the earth's crust during recent geological periods. Uplift has been broad and without local corrugations. The existence of the peneplane in a moderately dissected state, and the broad uplift of the region in recent geological times, have had great practical bearing on the conditions of settlement. For example, the Kimberley Ranges are merely the relics of the dissected plateau in which the rivers have cut deep gorges. The intergorge spaces are broad, moderately rolling, slightly dissected tracts, often well suited for pastoral purposes. Much of the range country in the Kimberley district is of this type and has already been leased for grazing.

The use of the moderately dissected upland country is difficult here and there where deep gorges must be traversed. In some places the dissection of the broad upland has gone much further than in the Kimberley region. For example in the Pilbarra region the upland rises to over 2,000 feet, with local highlands reaching to 4,000 feet, as at Mt. Bruce. The valleys are broad and the streams have cut the valley floors close to base level. This is an advantage from the point of view of communications along and across the valleys but would be less favorable for the grazing industry were it not for the greater elevation and the heavier rainfall induced thereby.

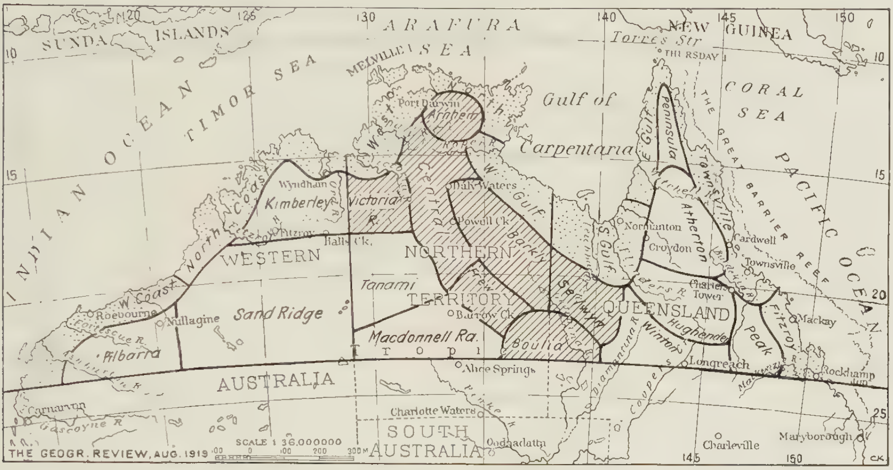

FIG. 2—Topographical divisions of tropical Australia. Coast lands are dotted, central uplands are ruled, western peneplane and eastern highlands are blank.

THE MACDONNELL RANGES

The old peneplane surface is surmounted by two other residual areas that are specially noteworthy. Near the Tropic of Cancer and almost in the middle of the continent from east to west are the Macdonnell Ranges (Fig. 3), which consist of a series of parallel ridges running east and west and rising to a maximum height of 4,786 feet in Mt. Heughlin. The ranges are crossed by the Finke River in an extraordinary series of gorges, which will have a distinct influence on future settlement. Many of the gorges are only a few yards wide and contain permanent pools of splendid water. They are ideal sites for reservoirs.

THE DESERT REGION

North and west of the Macdonnell Ranges the peneplane surface is desert in character. In the Tanami region the drainage is collected in shallow, salty depressions, and the pastoral area is limited to 500 square miles of well-grassed country. The sandy plain is dotted with mulga

(*Acacia aneura*) scrub and clay pans, and for several hundred miles at a stretch there is no permanent water except for a very small number of pools in rock holes. Toward the west the sand ridge or desert region has its greatest extent. This is the most inhospitable region on the continent, though most of its terrors have been minimized since a stock route was surveyed across it from Hall's Creek to Wiluna. In a day's march of some twenty miles Carnegie crossed from 60 to 100 sand ridges; in all, he traversed 420 miles of sand ridge country, the ridges being from 30 to 50 feet high and running approximately east and west. He described most of the country as a great undulating desert of gravel. Part of the region is underlain with artesian waters, but, at the present time, their use is a mere possibility. Mineralized localities have drawn the isolated settler.

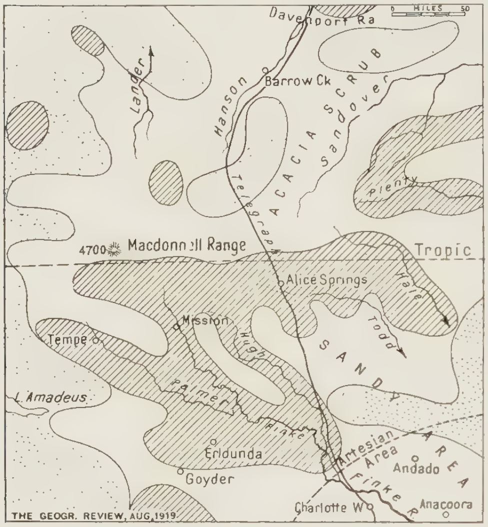

FIG. 3—Generalized pastoral map of central Australia in the region of the Macdonnell Range (based on Day's descriptions for the winter in 1916, which was distinctly wet). Ruled areas mostly well-grassed valleys with Mitchell grass and edible shrubs. Blank areas are rough or sandy country interspersed with fair grass flats and saltbush, etc. Dotted areas are chiefly spinifex and sandy country, feed scarce or absent; mulga (*Acacia aneura*) is almost universal. Permanent water is rare.

THE CENTRAL UPLANDS

East of the peneplane that forms the desert interior of tropical Australia is a region of uplands, once in much the same state of topographic development as the peneplane region on the west but now so well eroded by the headwaters of the Victoria and other streams that the original level is only indicated by scattered flat-topped hills. With a heavier rainfall the region supports many more cattle, and in the Victoria River uplands there are almost a dozen stations where over a thousand head are pastured. The land is fairly well watered and timbered.

The central uplands extend northward close to the sea, west of the Gulf of Carpentaria; and, although the soil is poor, there is a good deal of excellent grass in the bordering valleys and a certain amount of stock. The settlements are scattered along the telegraph line in the southern portion of the uplands, about 100 whites and 500 Chinese being engaged in mining, chiefly in the vicinity of Pine Creek. Wells are few and far between. The sparse population is indicated by the fact that even along the telegraph line for 300 miles, from Katherine to Newcastle Waters, there are only three men (at the telegraph office at Daly Waters). Eastward from the central uplands the rainfall increases, and in the Barkly Tableland region (Fig. 2) there is a great deal of grass, upon which graze about 150,000 cattle and 50,000 sheep. Permanent water being very scarce in a bad season, a number of the stations are temporarily abandoned. Half a dozen people are sufficient to control the grazing of a large area.

Atherton Plateau

The central portion of the peninsula that runs along the eastern side of the Gulf of Carpentaria is a dissected peneplane of considerable elevation, whose eastern edge has been sharply truncated to form a part of the eastern coast of Australia and whose western flank is a gradual slope. The backbone of the peneplane is a range, rising to 2,000 feet, with a few cattle stations and telegraph stations upon it and also a few mines. The heart of the region is the most promising tropical portion of Australia and is called the Atherton Plateau. Here lies a triangular area, about 12,000 square miles in extent, all of it over 2,000 feet high. It is a mineralized region, favored by good climate and soil, adequate rainfall, and accessibility to railways. It supports large numbers of cattle, including many dairy herds.

The Climatic Factor

The Tropical Region

Except for a portion of the Sahara the Australian tropics are hotter than any other region of the world. The northwest, especially, has an unenviable pre-eminence. The only parallel is the Madras coast in India, and this is slightly cooler.

As the Australian region is approached the heat equator swings south across the "line" to pass through Wyndham and Port Darwin and thence runs northeast to the Gilbert Islands in the Pacific.

A reference to Figure 4 shows that four regions in the world (of which records are available) have average annual temperatures exceeding 82° F. These are shown in Table I.

TABLE I—The Four Hottest Regions in the World

Place	Region	Average temperature	Average rainfall
Massowah	Red Sea	86° F.	10 inches
Timbuktu	W. Sahara	84° F.	Under 10 inches
Wyndham	N. W. Australia	84.6° F.	27 inches
Tinnevelly	S. E. India	84.3° F.	50 inches

The two African localities are so dry that discomfort is greatly decreased, even with the fierce heat. The Indian and Australian localities both experience heavy summer rains and are, consequently, very muggy during the wet season.

It will be granted that northern Australia does not benefit in climate from its position in the Southern Hemisphere. The accompanying graph (Fig. 5) illustrates its position with respect to the rest of the world.

We see that Australia, north of latitude 20° S., is hotter than the area to the north, *is hotter than the average Northern Hemisphere* and hotter than the average Southern Hemisphere for the same latitudes.

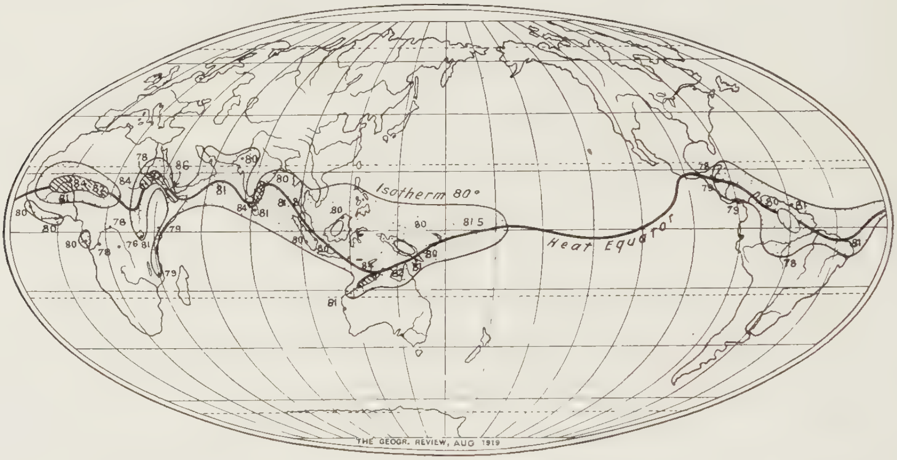

FIG. 4—The four hottest regions in the world—Timbuktu, Massowah, Tinnevelli, and Wyndham. Annual isotherm 80° F. and heat equator also shown. Regions with temperature over 82° F. are ruled. (Data from Hann's "Meteorologie.")

TEMPERATURE

The mean annual temperatures for northern Australia are given in Figure 6. The isotherm for 80° F. exhibits some peculiarities that deserve notice. The oblique direction of the hot belt is undoubtedly due to the prevalent southeast trade winds. On the eastern coast these winds tend to cool the land, as they come from the cooler ocean; but on the western side of the continent they are hot winds from the interior during a large part of the year and so raise the average temperature in the west. Hence, from the point of view of temperature, settlement is favored in the east and hindered in the west.

In the cooler months (May, June, July, and August) no portion of tropical Australia (except the Derby-Port Darwin coast) has a mean monthly temperature exceeding 80° F. It is unnecessary to emphasize the fact that in the greater part of the tropics—everywhere except the coastal fringe—the winter months have a delightful climate. But this statement applies only to the heat conditions, as the low winter rainfall militates against economic development.

In the hotter months (November-March) the whole of the tropics (except the coast south of Cairns) has an average monthly temperature exceeding 80° F. This is an undoubted disability, especially since these months also constitute the wet season. The effect of this high temperature on the health and comfort of the population can better be considered after the rainfall and humidity data have been noted.

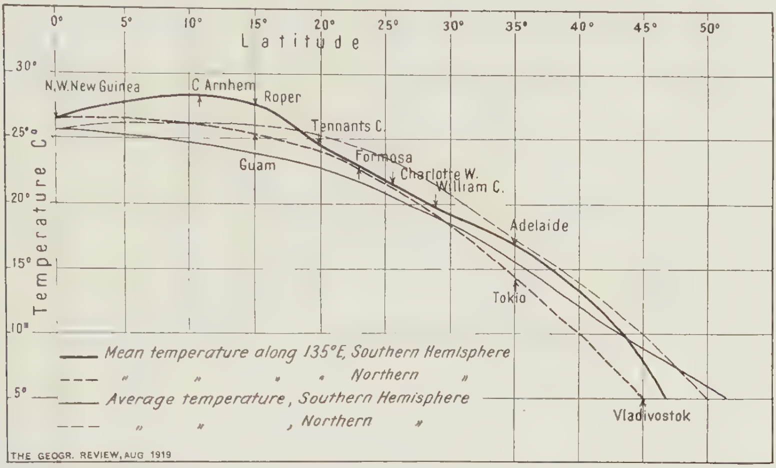

FIG. 5—Mean temperatures along longitude 135° E. (through Australia, etc.) in the Southern Hemisphere (thick line) as compared with those in the Northern Hemisphere (heavy broken line); also with average temperatures for the two hemispheres (thin continuous and broken lines). (Data partly from Hann.)

"Comfort," as a factor of settlement, appears to have been largely ignored up to the present. A high degree of health may be maintained, with constant care and moderation, under circumstances which cannot be termed comfortable. In a huge area like Australia, with much of the temperate zone only sparsely settled, it is obvious that prospective settlers will quite reasonably require something beyond conditions of bare health.

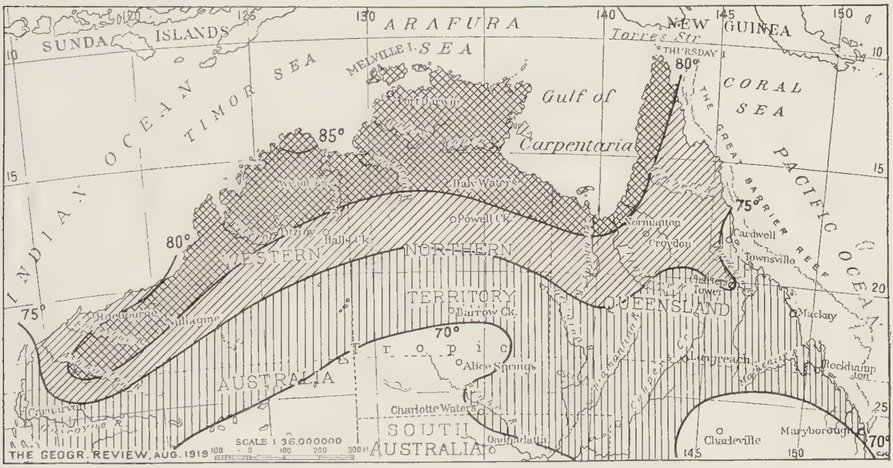

FIG. 6—Average annual temperature in tropical Australia (after H. A. Hunt).

No problem in Australia deserves greater consideration than that dealing with the conditions of comfortable life in the tropics.

Temperature and Elevation

As we have now considered the distribution of highlands and isotherms in tropical Australia, we may briefly discuss how much this region is benefited in climate as the result of elevation. One writer asserts that "there exist north of the tropics considerable areas of sufficient elevation to counteract, to a large extent, the climatic conditions usually found in such latitudes."

On an average, the temperature is reduced 1° F. by an ascent of 300 feet. It will be admitted that an amelioration of 7° F. is necessary to "counteract the climatic condition." This involves an elevation of about 2,000 feet—and all above this level we may provisionally class with tropical plateaus.

These regions in Australia (see Fig. 1) are, in their total area, unfortunately, very small—as shown in Table II.

TABLE II—Regions Above 2,000 Feet in Tropical Australia

Locality	State	Approximate area over 2,000 feet
Atherton Plateau	Queensland	12,000 sq. mi.
Clarke Range Area	"	2,000 "
Northern Macdonnells	Northern Territory	14,000 "
Kimberley Region	West Australia	8,000 "
Pilbarra South	" "	10,000 "
Total		46,000 sq. mi.

This area of 46,000 square miles is only 4 per cent of the total area of tropical Australia and is in fact practically negligible.

How much more fortunate are other tropical regions is shown at a glance by Figure 7. Here the corresponding portion in southern Africa is charted. For instance, in Rhodesia, there are some 400,000 square miles of tropical country, all above 2,000 feet elevation, and with a climate of a correspondingly more comfortable character.

Rainfall in the Tropics

While there is little doubt that rainfall is the element that exercises the chief control on Australian industries—and, therefore, on settlement—yet it is very important that wrong conclusions should not be drawn from rainfall maps.

In Figure 8 the average annual rainfall for the tropics is charted—the region of heavy rainfall being shown by the black and cross-hatched areas. These extend along the northern and eastern coasts, all of which receive over 40 inches per annum. The region of good rainfall (20-40 inches) has a similar arrangement. The tropic almost coincides with the 10-inch isohyet in the western and central areas, and no portion of tropical Australia receives less than 10 inches in normal years.

From a casual glance at the map there would appear to be little to choose between the northern and eastern portion of the tropics as regards this element. No greater error could be made. Whether from the point of view of grazing, agriculture, or of health and comfort, there is a strong distinction to be made between the rains of these two regions.

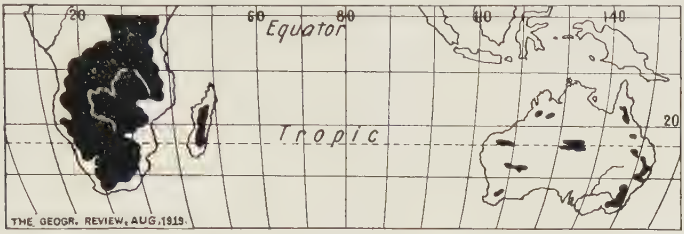

FIG. 7—Regions above 2,000 feet in southern Africa and in Australia. The difference in climate between northern Australia and Rhodesia (area shown by white line), as the result of elevation, is very marked, though they are in the same latitude.

Both belong to the summer rain belt; but, whereas the northern precipitation is confined wholly to the summer months (and in fact for the greater part of this area to the four hotter months), the eastern rain is much more uniform. In addition to the period December-March there is also considerable rainfall in November, April, May, and June. This is due to the prevalent southeasters and to the frequent occurrence of tropical lows passing down the Queensland coast.

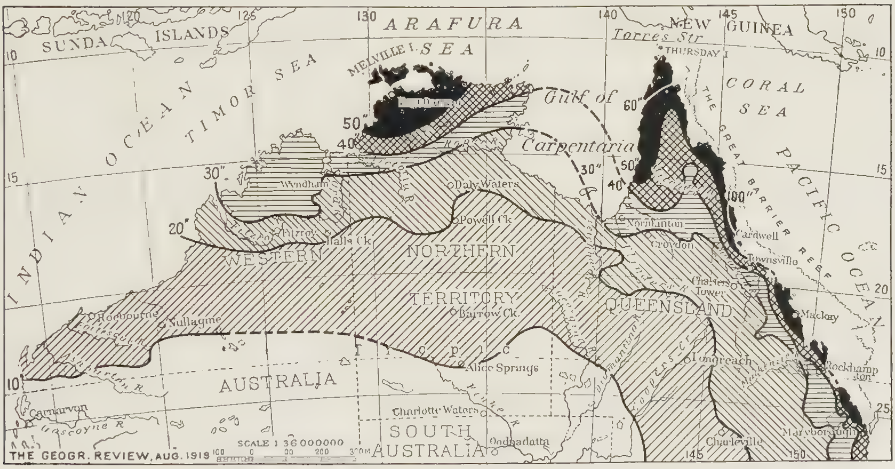

FIG. 8—Average annual rainfall (in inches) in Australia (after H. A. Hunt).

Only along the actual coast line in the north and east does the rainfall compensate for the evaporation. In the interior the rainfall is just about one-tenth of the evaporation, and there is no need to dwell on the effect of this enormous withdrawal of moisture upon the resources of the tropics. The well-watered region of the Australian tropics is confined to eastern Queensland. The rest of the tropics has six, seven, or eight months of drought every year (Fig. 9); but this evil feature is compensated to some extent by the presence of an indigenous flora which flourishes through long adjustment to environment.

There is one other aspect of rainfall that is of considerable interest. It is well known that in some regions of Australia the rainfall is much more reliable than in others—quite irrespective of the amounts. Thus the 20 inches that the wheat farmer can expect to receive with some certainty in the Katanning district of West Australia is much more valuable than the 20 inches which may fall in Wiluna in the course of a few days.

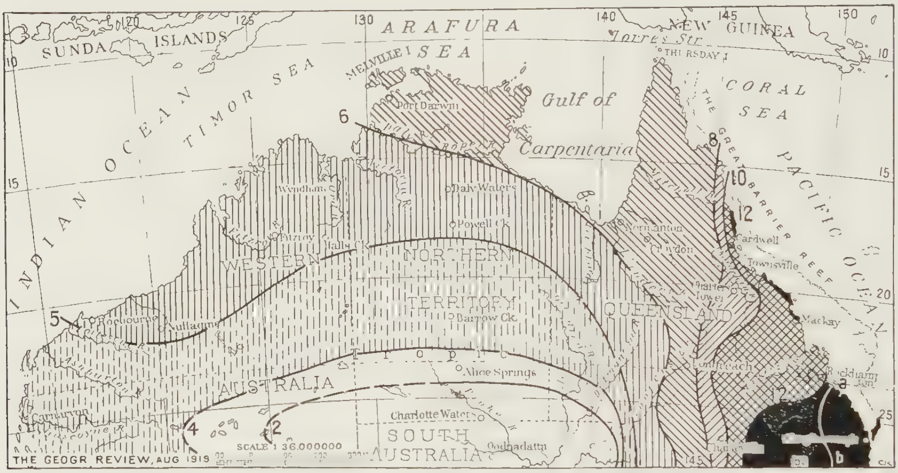

FIG. 9—Rainfall uniformity map. The figures represent months receiving more than one inch of rainfall.

The reliability map (Fig. 10) shows that Port Darwin and Thursday Island vary less than 20 per cent from their normal amount and that the variation increases inland. Kimberley comes out rather well, but the Pilbarra region is highly erratic; and the rainfall of the Barkly Tableland is also unreliable. The Macdonnell and Frew River regions are slightly better than the surrounding districts. This map is of considerable importance in connection with all suggestions of crop growing in the Australian tropics. It has been asserted that the Barkly region, and even the Macdonnells, will grow wheat without irrigation; but, even if the rainfall were suitable in average amount and in season, this map shows that it is too erratic to justify agriculture in those regions.

HUMIDITY

Humidity, quite as much as temperature, controls the health and comfort of settlers in the tropics. Speaking generally, regions of high humidity are unfavorable for white settlement.

In July (Fig. 11) the only region with high humidity is the Cape York Peninsula, while the Port Darwin region and the Townsville coast have moderately high humidities. In January (Fig. 12) conditions are, of course, much worse. All the coastal regions and a considerable belt inland exceed an average of 60 per cent. Only in the Pilbarra region is there a hinterland with a moderate humidity in summer.

It will be seen that the elements rainfall and temperature operate in different directions as regards products and as regards comfort respectively. High rainfall and high temperature mean, usually, a more fertile land with greater resources, and in this respect the eastern tropics have the advantage. But low rainfall and low temperature mean low humidities, and in this respect the western tropics are, on the whole, more comfortable—at any rate during the summer months.

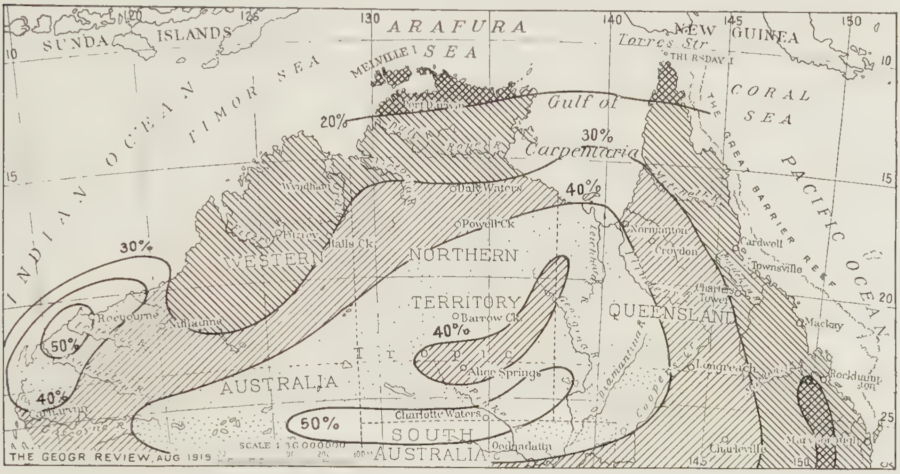

FIG. 10—Rain reliability map. The figures represent the percentage variations (from the normal annual rainfall) which may reasonably be expected. (Based on data 1891–1910). The cross-hatched areas are most reliable, and the white and dotted areas the least reliable.

Natural Vegetation

The most direct evidence of a country's possibilities for settlement is furnished by the natural vegetation. It acts as an index of the soils, the rainfall, and the temperature. On these conditions are founded the great primary industries of agriculture and grazing. If only two maps were available for an economic forecast, then the geographer, for the above reasons, would prefer the vegetation map and the geological map, which, in a similar fashion, furnishes the key to the topographic and mineral aspects of the problem.

No error is more common on the part of geographers than their indication of the northern quarter of Australia as covered with a tropical forest. They have been misled by the heavy annual rainfall and do not realize that—as has been previously pointed out—there are in the northern tropics six months of drought in each year. This does not prevent the growth of fairly large trees, but it does account for the absence of true tropical forest filled with lianas and undergrowth, which latter are practically confined to the eastern coast of Queensland.

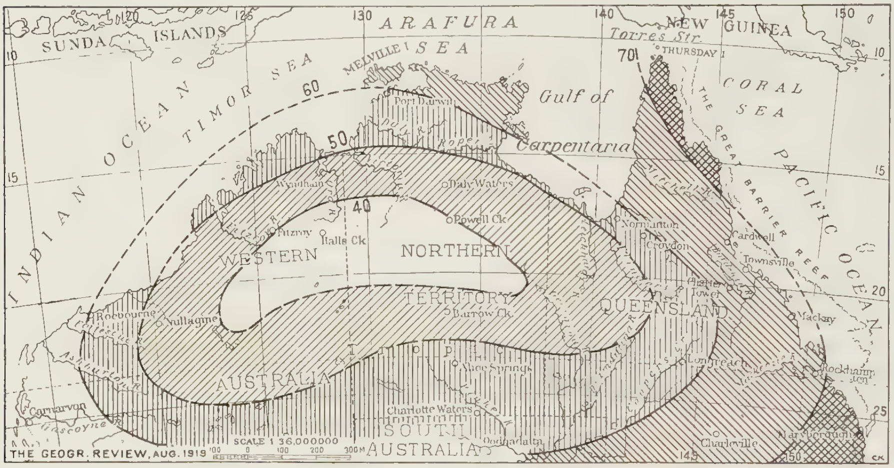

FIG. 11—Average relative humidity for July. Note that Thursday Island is much worse than Broome.

The broader features of the native vegetation are shown on Figure 13.

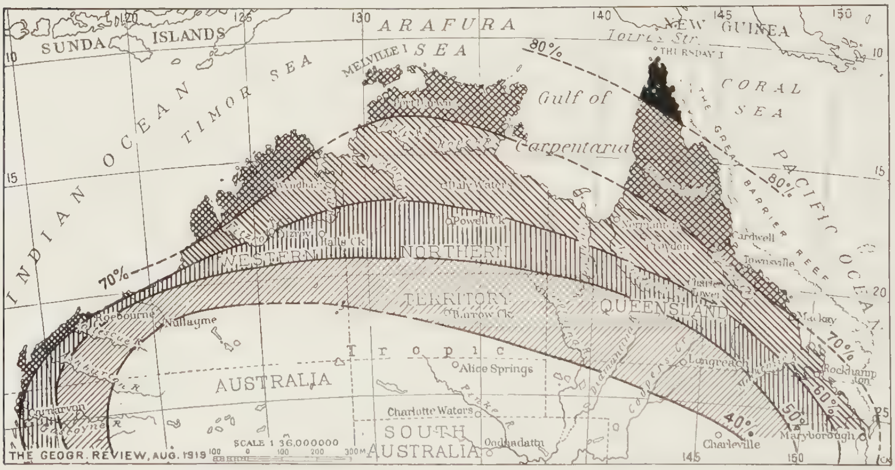

FIG. 12—Average relative humidity for January. (The western coast between Roebourne and Carnarvon should be ruled to indicate 60%–70%.)

THE SAND RIDGE COUNTRY

The desert portion of tropical Australia, or the so-called Sand Ridge region, contains thickets of spinifex and clumps of mulga, with other trees growing sparsely in the hollows. The chief economic plant is the fleshy parakeelia (*Portulaca*). Toward the northern edge of the desert the vegetation becomes more abundant, with fine specimens of the ubiquitous gum (*Eucalyptus rostrata*) in the creek beds where ground water is available. Saltbush and coarse grass are not rare on the protected western and northern sides of the ridges. It is a striking fact that a supply of drinking water may be found only 20 to 30 feet below the surface.

On the Macdonnell Ranges the principal peaks, which rise 2,000 feet above the plains, are bare of foliage; but gums and spinifex grow on the lower slopes while the plains are covered with saltbush and native grasses, alternating with belts of mulga.

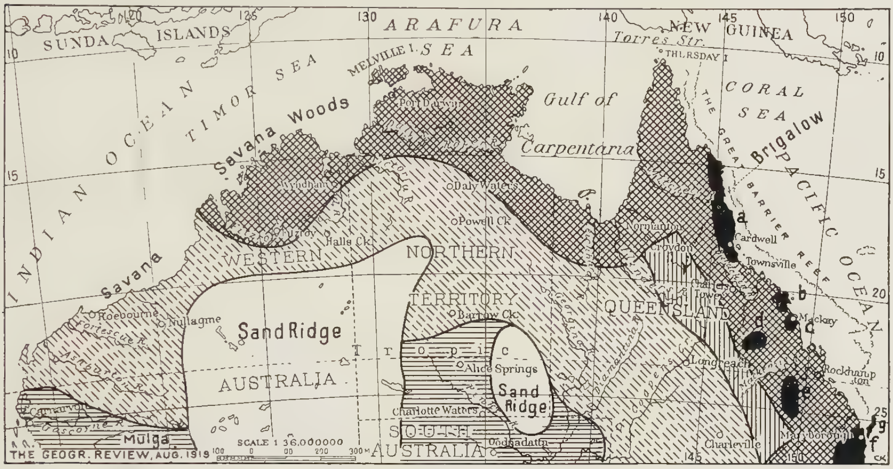

FIG. 13—Main features of the vegetation of tropical Australia. Timber forests are black; *a*, *b*, *c*, and part of *f* are tropical rain forests; *d*, *e*, *f*, and *g* are valuable eucalypt forests. Note that the provinces merge into each other. (Based in part on Diels and Jolly.)

THE SAVANAS

One of the most extensive belts of vegetation is the savana, or prairie type, which extends from North West Cape, on the extreme western edge of tropical Australia, eastward through the greater part of the hinterland north of the Tropic of Capricorn, reaching into the sand and mulga country of the dry interior and into the savana woods on the wetter coastal margin. At places it is marked by widespread areas of small trees belonging to the eucalyptus and acacia types, but its general aspect is that of an open grassy plain with an abundance of bird life and native game. The savana type of vegetation reaches its perfection in the uplands of the Barkly and upper Victoria basin region and in central and western Queensland.

FOREST AND OTHER REGIONS

Where the edges of the tablelands invoke a heavier rainfall (25 or more inches a year), as about the borders of the Kimberley region, there is a zone of woodland in which eucalyptus dominates, grass grows everywhere, and undergrowth is practically absent. It is a "park-land" type of country. Eucalyptus is not the exclusive tree; there are pines, the baobab, the kapok, and other characteristic woods of the tropics; but the trees are isolated and there are no true forests. Hardly any jungle exists, only a patch here and there. The size and position of true tropical jungle areas of any considerable extent are indicated on the map (Fig. 13).

Along the eastern coast of Queensland the rainfall is much more regular and the forests more luxuriant, although the greater portion is still of the open "park-land" type with a close undergrowth of grasses. The wood consists of eucalyptus, such as ironbark, bloodwood, stringybark, etc. Hardwood forests of special economic value for timber are confined almost wholly to the temperate portions of Australia. In tropical Australia they have been exploited only in eastern Queensland.

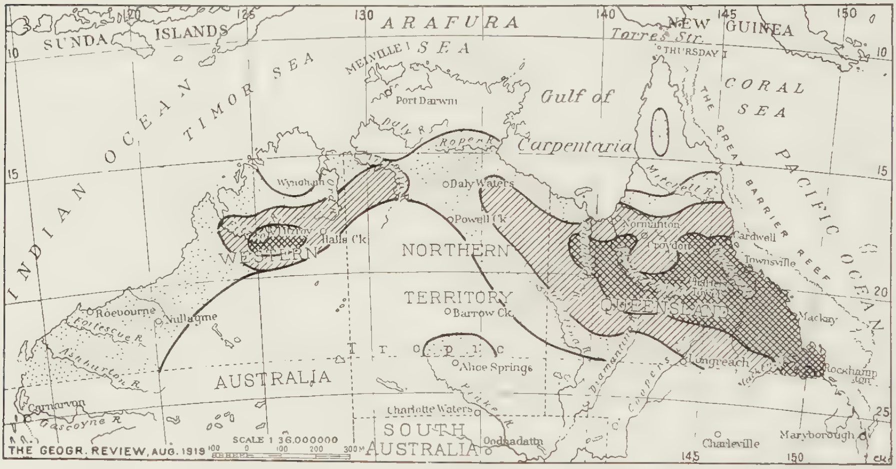

FIG. 14—Distribution of cattle (about 1912). Very numerous, cross-hatched; medium, ruled; sparse, dotted.

All about the Gulf of Carpentaria the country is low and, on the whole, poor from a pastoral standpoint. The vegetation is coarse grass and stunted gums. With the exception of Borraloöla and a few mission stations there is hardly a settlement along the western and eastern sides of the gulf.

Economic Resources

PASTORAL RESOURCES

The chief asset of tropical Australia is grass. Sufficient development has taken place to enable the geographer to classify the best areas for grazing, and to determine the regions where future increase is most probable.

In Figure 14 is shown the distribution of cattle about in 1912, and there has not been much alteration since. Rockhampton has the densest distribution, but all along the Northern Railway in Queensland there are about 20 cattle to the square mile over large areas. On the Fitzroy River, in West Australia, a similar density obtains. In other regions of the tropical division the density is much less; and there are practically no cattle in the wettest regions (over 50 inches a year) and in the driest regions (less than 10 inches).

Hence the best cattle country is determined primarily by the rainfall and lies between the 15- and 40-inch isohyets—the 20-inch being perhaps the best. Assuming that the newer northern and western regions will progress along similar lines, then a glance at the rainfall map (Fig. 8) shows that the chief advance will be made in Kimberley (W. A.) and the Northern Territory.

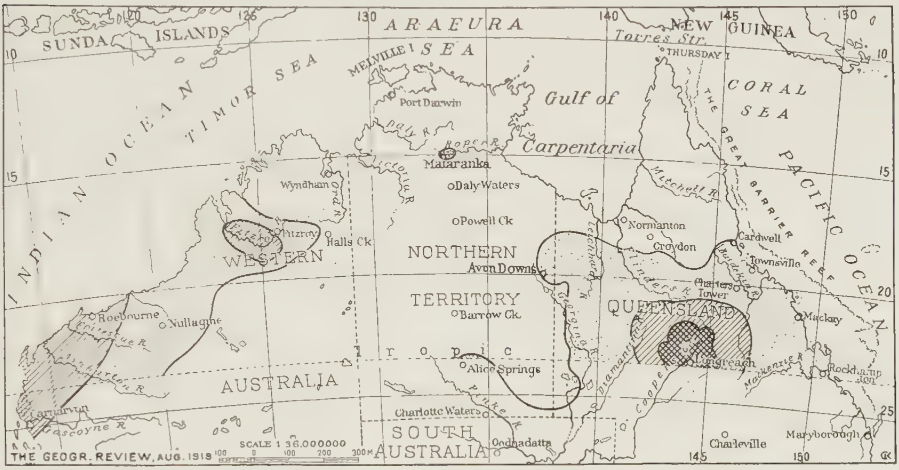

FIG. 15—Distribution of sheep (about 1912). Very numerous, cross-hatched; medium, ruled; sparse, dotted.

There is, of course, some rivalry between cattle and sheep. The latter pay better on country which is suitable for either—but in the wetter and warmer coastal regions the hardier cattle do better than sheep. Moreover, they can travel farther for water and live on rougher feed—so that the newer territories will probably be developed first as cattle stations.

Dairies will continue to multiply in such regions as the Atherton Plateau, where there were 450 in 1913, and along the central Queensland coast. But the long dry winter is likely to prevent extensive dairying in any other portion of the tropics. Some experiments in dairying are, however, being tried at Port Darwin.

It is worthy of note that the Indian buffaloes do well in the wettest and hottest regions of Australia, where ticks, disease, and coarse grass have given great trouble to European cattle.

In Figure 15 is the corresponding map showing the distribution of sheep in tropical Australia. They are densely congregated near Longreach, in Queensland, but do not bulk largely at present anywhere else. The Barkly

Tableland, however, grazes over 50,000 at Avon Downs, and there are about 10,000 in the Macdonnell Ranges, while an experimental flock of 2,000 is progressing satisfactorily at Mataranka, far to the north. With increased facilities the sheep belt may be expected to spread across through the Territory along the 20-inch isohyet, to meet the valuable sheep tracts on the lower Fitzroy in West Australia. It seems doubtful if the rougher, wilder country of the tropics will be used for sheep until present conditions have almost disappeared; the chief immediate extension of the sheep country will probably occur rather in temperate regions.

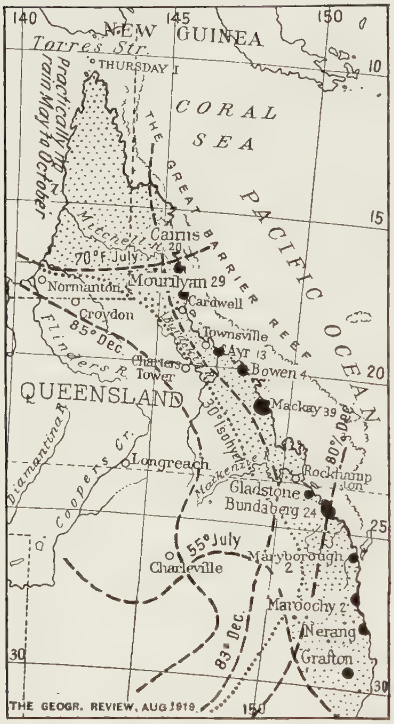

FIG. 16 — The sugar region in Queensland, shown by black areas (figures are thousand acres). Controlling isotherms in January and July are given and also the 30-inch isohyet (read thus for "30° Isohyet").

THE SUGAR INDUSTRY

In northern Queensland, between the tropic and latitude 15° S., there is a thriving industry of special interest, because it appears to be the only important example of tropical agriculture carried out by British labor. Over 27,000 white people are engaged in this industry along the northeastern coast of Australia from Grafton (N. S. W.) to Cairns (Queensland).

In Figure 16 the climatic controls governing the crops are indicated. The rainfall control is the most important and confines the plantations to the coast, where the rainfall (or equivalent irrigation) exceeds 40 inches a year. The southern limit is determined by the temperature in the coldest month. Grafton is, of course, far south of the tropic. The northern boundary is probably fixed in Queensland by the fact that in the Cape York Peninsula the total rainfall—though abundant enough—is not uniform, and for the six winter months in the year very little rain falls north of Cooktown.

The map also shows that nearly twice as much sugar is produced in the northern tropical coasts as in those south of the tropic. Mackay is the chief center. Here there were 39,050 acres devoted to sugar in 1915, and the yield was about 30,000 tons. The total for the tropical coasts was 103,000 tons.[2]

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[2] Queensland Statistics, 1915.

Possibilities of Agricultural Production

Next in order comes the consideration of the suitability of the Australian tropics, *per se,* for such important products as wheat, rice, cotton, tea, and coffee.

As in the study of human comfort, discussed elsewhere,[3] it is helpful to use the graphic method. The two chief controls which determine the suitability of a region for plant life are temperature and rainfall. Soils are of great importance, but in this huge tropical tract there are hundreds of acres of fertile river flats that have never been developed in the slightest—so that the soil can be assumed to be satisfactory. The seasonal variations in heat and moisture are also of great importance, and the method to be described seems to illustrate this very satisfactorily.

To the graph representing these controls the name hythergraph has been given, based on the Greek words for rain and heat. The graphs are drawn just as were the ''climographs'' in the paper cited but on co-ordinates of rainfall and temperature.

In Figure 17 the hythergraphs for typical localities in the Australian tropics are given. The graph for Port Darwin lies almost wholly on the 83° temperature abscissa. This is what one would expect from its position near the equator. The rainfall range is very great—from 15 inches in January (extreme right) to negligible amounts in midwinter. As we move southward the hythergraph changes to the opposite type, which is illustrated by Alice Springs. Here the rainfall varies but slightly—from 50 points to 150 points a month; but the temperature range is great—from 83° F. in January (*J*) to 51° F. in July (*JL*).

Intermediate localities partake somewhat of both types. Thus Rockhampton has a hot season resembling Port Darwin, with constant temperatures (about 77° F.) and very variable rainfall; and a cooler season, with more constant rainfall (1 to 2 inches) and very variable temperature (from 60° F. to 75° F.). Longreach typifies the inland towns and approximates to the Alice Springs type.

The unusually satisfactory conditions on the Atherton Plateau in northern Queensland are illustrated by the hythergraph for Herberton. This belongs to the summer-rain type; but, owing to its elevation of nearly 3,000 feet, it is almost 10° cooler than Rockhampton, far to the south. It is a thousand pities that there are not more of these tropical plateaus in Australia. Many valuable crops would grow excellently there.

WHEAT

Let us see how the hythergraph method helps us with regard to wheat possibilities. In Figure 18 many typical wheat localities are plotted, and

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[3] *Commonwealth Bureau of Meteorol. Bull. 14*, Melbourne, 1916. See *Geogr. Rev.*, Vol. 4, 1917, pp. 401-403, and Vol. 5, 1918, p. 86.

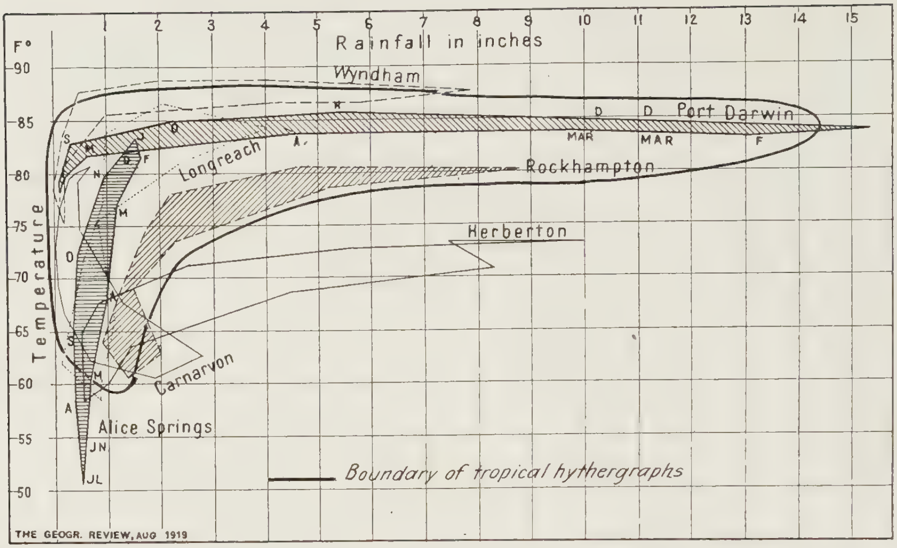

FIG. 17—Typical hythergraphs for tropical Australia. The initial letters refer to the months. Horizontal distances represent rainfall per month; vertical distances, temperature. Wyndham represents the hot northwestern coast, Carnarvon the dry southwestern coast, Port Darwin the hot wet northern coast, and Rockhampton the hot wet southeastern coast. Alice Springs is in the arid interior. Longreach is good inland sheep country. Herberton is a cool plateau. The heavy boundary includes all the typical localities.

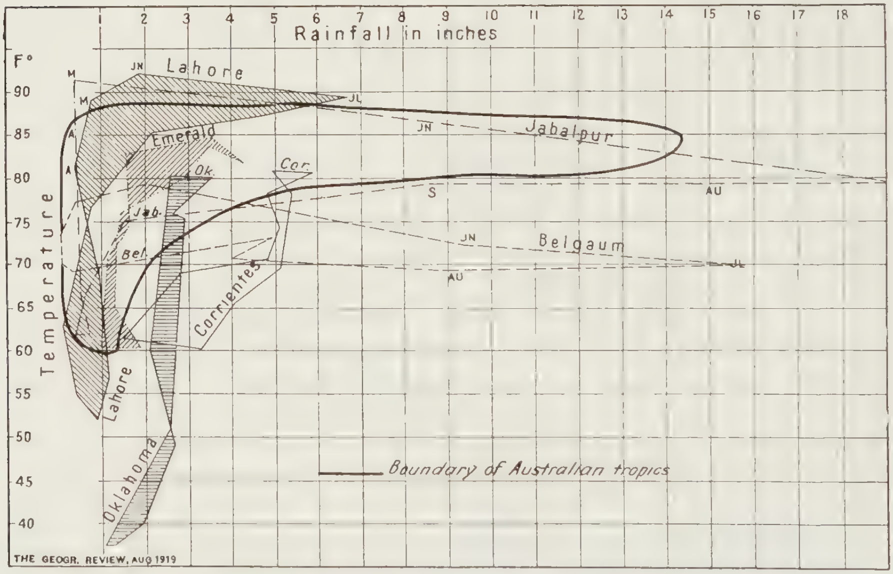

FIG. 18—Hythergraphs for wheat. The wheat of temperate regions closely resembles the Oklahoma graph. Hot-climate wheat grows at Lahore, Jabalpur, and Belgaum (India) and at Corrientes (Argentina). Emerald (Queensland) is inserted for comparison. The heavy black line is taken from Figure 17.

their position with respect to the aforesaid "Australian boundary" can be seen at a glance.

The chief wheat lands of the world are in the United States, south-eastern Europe, and India. If we plot type localities we find that there is a big range of possible controls (especially in rainfall) in some of the less important regions. But Minneapolis, Oklahoma, Bucharest, and Albury (N. S. W.), to choose four well-known regions, are all of the type shown by the Oklahoma hythergraph. There is great range of temperature but not so much range in rainfall. The wheat is often planted in the autumn and lies dormant during winter, to start vigorously in spring and be harvested about midsummer.

But there is another type of wheat harvest, and this is the one which concerns our tropical lands. In India the wheat is sown at the end of the hot weather, when the heavy rains are over, and depends chiefly on the moisture in the soil rather than on the rainfall during growth (though this also helps, of course). Under these conditions wheat is grown as far south as southern Bombay (near Belgaum, 16° S. and 2,000 feet elevation) and, more largely, near Jabalpur on the tropic. The typical area is, of course, in the Indo-Gangetic plain, and Lahore will serve as an example. The wheat is reaped at the close of the cold weather, in April or May.

The northern limit of extensive wheat culture in Australia lies at present in latitude 26° S., or well south of the tropics. But there is no climatic reason why special wheats should not grow very much farther north in the Queensland hinterland.

The chief Indian wheat areas have an average temperature of 75° to 79° F., while in the growing period the temperatures range from 64° to 71°. These latter temperatures are precisely those of eastern Queensland. Thus in inland Queensland, south of Bowen, the region from Mackay to Charleville has the same dry winter and spring with only 5 to 10 inches of rain.

Emerald (on the tropic) receives 14 inches of rain in the wet season. The wheat might be grown on the Indian method, that is it might be sown early in March. It would ripen in about four months, before possibility of frost or severe cold, and would receive therein an additional five inches of rainfall. The hythergraph for Emerald is shown on Figure 18, where it is seen to lie midway between Lahore and Oklahoma.

A similar warm wheat region is illustrated by the graph for Corrientes (northern Argentina). Here, however, the average rainfall is considerably greater.

It will be seen that the Herberton district is closely paralleled by Belgaum in the higher portion of southern Bombay; while Jabalpur is, to some extent, a homoclime of Port Darwin and shows that it is possible to grow some wheat even in such a tropical region as this. But it must be remembered that in India these conditions of rain and heat are general over large plains and extensive plateaus of rich river-alluvial or decomposed volcanic débris. In tropical Australia such extensive areas are non-existent; and, speaking generally, the northern wet regions seem, unfortunately, to be either rather poor in plant food or, if fertile, very restricted in extent.

While recognizing that these theoretical considerations are of much less value than practical tests, which various authorities are beginning to carry out, the above discussion may be novel and valuable as regards potentialities and comparisons with the homoclimes elsewhere. At any rate these graphs deal with average conditions, which cannot be tested in the field until many years have elapsed.

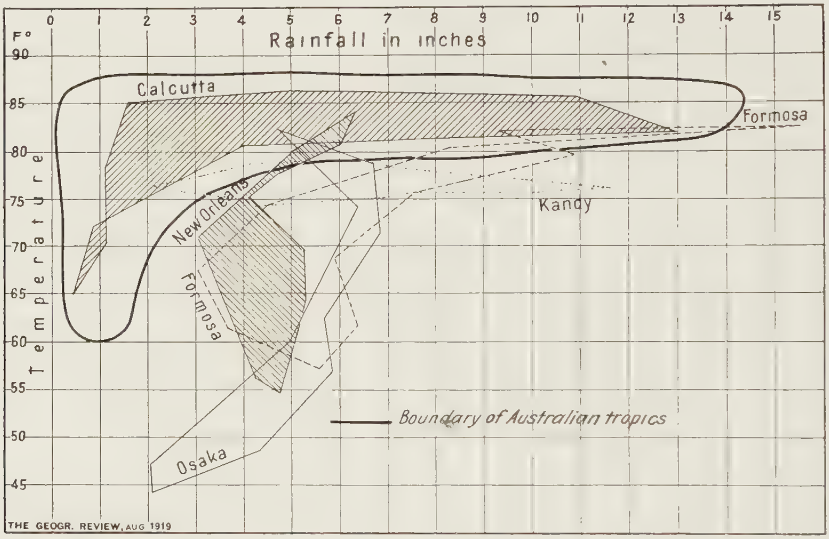

FIG. 19—Hythergraphs for rice (Calcutta and New Orleans) and tea (Kandy as in Ceylon, Formosa in China, and Osaka in Japan). The heavy black line is taken from Figure 17.

RICE AND TEA

Hythergraphs are shown for rice and tea in Figure 19, with the addition of the Australian boundary line to act as a criterion. Rice is grown (usually, of course, with irrigation) in great quantity near Calcutta, whose graph is seen to resemble closely that for Port Darwin or Cairns, near which suitable river flats occur. There is, however, in Australia no tropical region with a climate resembling that of New Orleans, where also large crops of rice are grown. When we remember that rice is grown satisfactorily in northern Italy, we realize that this plant has a tremendous range of habitat and will, undoubtedly, flourish anywhere in the Australian tropics where rainfall and soils are suitable.

As regards tea, it is suited by cooler and wetter conditions for the most part. The homoclimes of Kandy and Formosa suggest the Atherton

Plateau as the only promising field; but the great temperature range successfully resisted by Japanese teas (see Osaka graph) seems to indicate a field for tea in southeastern Queensland, just south of the tropics.

COFFEE AND COTTON

Coffee is illustrated in Figure 20. The graph for Juiz is very close to that of Herberton—as we should expect, for coffee has been grown in the latter district. Juiz lies 100 miles north of Rio de Janeiro, in Brazil, in the center of the chief coffee district in the world. The hythergraph for another coffee region—Mysore, in southern India—is also given. This is one of those elevated tropical regions in which Australia is deficient.

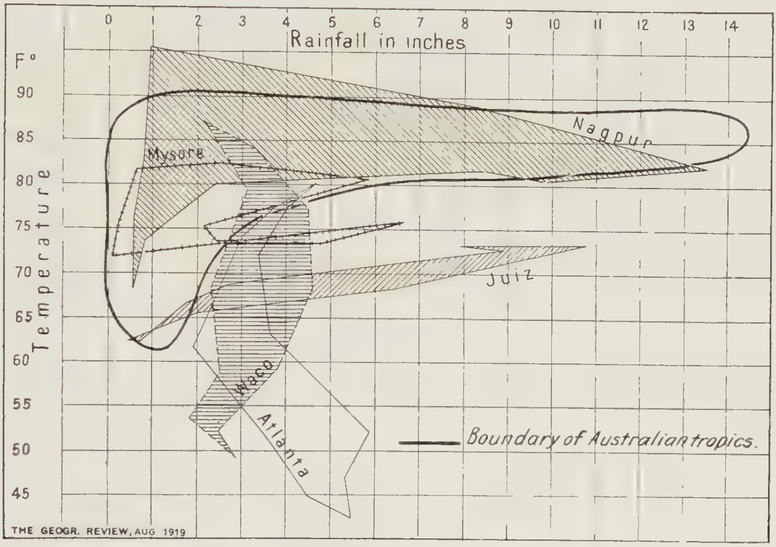

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FIG. 20—Hythergraphs for coffee and cotton. Atlanta and Waco are great cotton centers in the United States. Nagpur shows a tropical cotton area in India. Juiz (Brazil) is the center of the chief coffee area. Mysore shows a hill coffee area in southern India.

Cotton is a crop which grows under conditions somewhat similar to those for wheat. In the United States the great cotton belt experiences much cold weather, as is evident from the hythergraphs for Waco (Texas) and Atlanta (Georgia). But there are also large crops of tropical cotton—such as those of central India. The graph for Nagpur (21° N.) is sufficiently like those of the wetter tropical coast lands of Australia to be very encouraging.

CROPS IN NORTHERN TERRITORY COAST LANDS

The graphs discussed above will serve to show how the climate compares with those of other analogous regions of agricultural importance. But mention must be made of the lengthy experiments on tropical agriculture carried on near Port Darwin.

At Bachelor the following crops were grown on a fairly substantial scale during 1914 and 1915: cowpeas for fodder and manure, 50 acres of rice, 25 acres of maize, 14 acres of lucerne (which was choked by the rank grass), 12 acres of Hungarian millet, and 3 acres of wheat. The early onset of the dry season seriously affected most of these crops, especially the wheat.

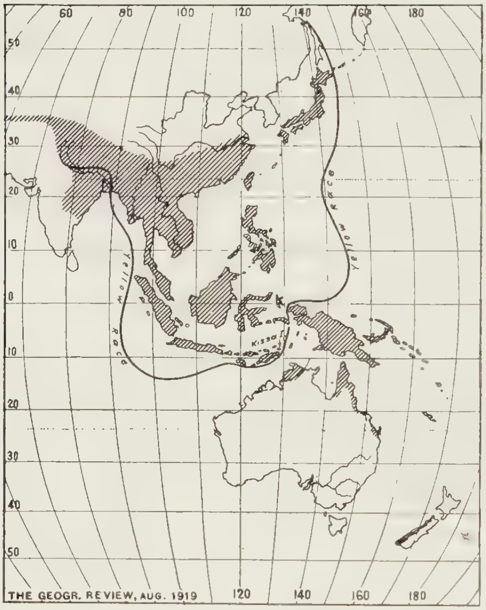

FIG. 21—The yellow race in the tropics. They have settled exclusively in regions receiving over 50 inches rainfall per annum (shaded area). Only the regions immediately around Port Darwin and Thursday Island and Cairns have a similar climate in Australia.

At Daly River corn and cowpeas were grown, and numerous pigs flourish on the native lilies in the *billabongs.* At the Botanic Gardens there were experimental plots of coffee, groundnuts, cassava, and various types of rice, which have given encouraging results.

Of these crops the Administrator writes: "Purely tropical products, as grown in other similar parts of the world, such as cigar tobacco, sisal hemp, cotton, tea, coffee, etc., are obviously out of the question here, where abundant cheap labor is unobtainable. Efforts, therefore, must be directed towards those crops (rice, etc.), which may be grown by aid of labor-saving machinery." He remarks that an agricultural laborer who has anything to do with farm machinery expects £4 per week. "I know of practically no soil (save very rich soils close to great centers of population) which, at any rent or no rent, will enable agriculture to be conducted in such circumstances."[4]

The Race Question

Some observations on the race question may be of interest, although they touch on political as well as geographical principles.

The White Race in the Tropics

The subject of the white colonization of the tropics has been treated fairly fully, considering how handicapped it is by lack of evidence. The only tropical regions of any extent colonized by white peoples are the

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[4] Northern Territory Report, 1915.

Sudan, Abyssinia, and southern Arabia—and the white peoples concerned all belong to the Semitic and Hamitic branches of the Indo-Aryans. The Syrians, who are occasionally met with in Australia, are members of this important group.

Elsewhere the Aryan race is comparatively unimportant. The Indians of Bombay and the Portuguese and Spanish of tropical South America practically exhaust the list. Australia—especially northern Queensland—is the only important tropical area settled by northern Europeans, so that the evidence furnished in this region is of especial value. It is, however, to be noted that there is little settlement in Queensland within 16° of the equator.

If we glance at a map of the tropics as settled by the yellow races (Fig. 21), we are struck by the fact that all such tropical lands have an abundant rainfall, in which they differ greatly from Australian tropical areas. Only the merest fringe around Port Darwin and Cairns recalls the lands of Java, Borneo, Siam, and southern China. The yellow race is nowhere indigenous in regions with a hot, dry climate, such as the Australian hinterland or Rajputana.

The White Australia policy—for good or evil—effectually blocks all settlement by Mongols, Indians, or half-castes. In connection with the last type, some mention should be made of the Dutch half-castes of Kissa Island. This island lies off Timor (Fig. 21) and is only 400 miles northwest of Port Darwin. In 1665 (according to Professor Macmillan Brown, of New Zealand) eight Dutch soldiers were abandoned here. Their progeny, numbering 300, still inhabit Kissa and often have light hair and blue eyes, though the skin becomes as dark as that of an Italian as these fairer individuals grow up. Professor Brown's conclusions are of much interest to Australians. "The main cause of their vitality and vigor I take to be their dry and barren islet (which is only six miles long and yet supports 6,000 people) compelling them to work if they are to live. Droughts are bad and eliminate the unfit. In the tropics moist heat is on the side of luxury and idleness, and it reinforces our natural inertia and longing for ease. The dry heat of the Australian plateaus interferes little with that vitality and energy which makes life a healthy pleasure. As long as human life keeps to the plateaus in tropical Australia and is bred in moderately hard conditions, it will not cease to perpetuate itself in a vigorous posterity. That is the lesson of Kissa."[5]

Two Possible Methods of White Settlement

Since settlement is to be confined to the white races, two courses seem open. Ravenstein has answered the question as follows: "If the white man is ever to occupy, permanently, the tropical parts of the world, it will have to be done by stages—each stage making a generation of men.

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[5] Macmillan Brown in *Sydney Morning Herald*, 1912.

For instance, in Eurafrica, a steady stream is setting southwards. Germans and Belgians are pouring into France, Frenchmen are going to Algiers, Arabs to the Sudan, and the Sudanese are pushing forward into Bantu Africa.''

It might be possible to accelerate this migration over some stages and to introduce into the tropical coast lands of Australia those Europeans who are most fitted by previous environment. These would undoubtedly be the Spanish, Italians, and Maltese. They would obviously be several generations ahead of any British immigrants in the required cycle of climatic evolution. Unfortunately they tend to leave their wives at home in Europe[6]; and, as Dr. Gilruth points out, though they are paid extremely high wages in the Territory, ostensibly to support their families there, the money largely goes out of the country. This method of settlement has not, therefore, helped Australia very largely up to the present.

And so we are left to the alternative. It is a perfectly natural method and one that would have a chance of success if the world were not already a welter of nations, jostling each other in their need for a place in the sun. As foreshadowed above, the method consists merely in a slow migration from cooler to warmer regions accompanied by generations of gradual acclimatization.

In his own experience the writer has passed through the stage necessary to accustom an Englishman from Sheffield (which has an annual temperature of 48° F.) to the climate of Sydney (with an annual temperature of 63° F.). This is merely a matter of a few years—though longer for middle-aged folk. A shorter period is necessary for the Englishman in Melbourne—none at all in Hobart. But in the uniformly hot climate of the tropics a very different period of acclimatization is needed.

The average white settler has not yet become accustomed to the worst months of the northern Queensland coast. It may become easier for his children, but it is undeniable that infant mortality is much greater in the tropics than in cooler regions. It is this latter fact that makes the experiment so protracted and costly. A strong, vigorous Englishman, with a respect for the rules of hygiene, can exist in some comfort in any region from the equator to the pole; but not until he can rear his children in the tropics, with no higher a death rate than in more favored regions, can he be said properly to have conquered the tropics. Needless to say, this happy state has not yet been approached; and we can only hope that time—that indispensable factor—will be granted to Australia to carry on the experiment. Probably the sugar plantations in northern Queensland offer the most striking attempts; and it speaks well for the future that it is possible to carry on farming operations with white labor, even with such artificial adjuncts as bonuses and unprecedented labor conditions.

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[6] Dr. Thomson states that Italians with their families are settling permanently in the sugar areas north of Bowen, that is in latitude 20° S.

As the writer has said elsewhere, "It has been pointed out that white adults can live in almost any part of the tropics in a healthy condition—and this is certainly the case in the Territory—provided that certain necessary precautions in housing, diet, and hygiene are obeyed. It is precisely this necessity for special care and increased exercise of common sense which is found so irksome by the average newcomer to a tropical region. Especially is this the case in the wet period, when a large measure of energy is required to overcome a natural lassitude." The well-housed wife of a senior official with efficient colored servants is in a very different position from the poor immigrant woman; but it is the feelings of the latter that will largely control future close white agricultural settlement along the northern coasts.

A Slow and Difficult Process

How the struggling white farmer's wife is to rear her babes, handicapped by a tropical climate and probably assisted only by ignorant black *gins,* is a problem of which no solution is at present obvious. It is a vicious circle. The white immigrant will not go there because the disabilities—largely due to the sparse population—are so great; and the population is, obviously, so sparse because there are so few immigrants.

If, however, Australia is left alone until conditions of life become much more strenuous in the favored southern areas, then the increased economic pressure will produce the needed influx of immigrants already partly acclimatized to warm climate conditions. But a long lapse of time is indicated, especially as Australia is now notorious as an example of the growth of cities at the expense of the rural population.

A glance at the humidity charts (Figs. 11 and 12) will show that there is a great difference between conditions of life in the northern coast lands from Derby to Cairns and those in the east from Cairns to Rockhampton. Hence, although we know that sugar cane (for instance) is a feasible crop for white labor along the latter coasts, it would be rash to assume that agriculture is, therefore, certain to succeed under white labor along the other more tropical coasts.

Seeing, for example, that only twice in three months in 1917 (January-March) did the wet-bulb temperature fall below the value of 73° F. (which Lamb and others have accepted as the limit of comfort), the prospects of economic white farming along the northern coasts during all the summer months do not seem at all promising.

Future Prospects

We have now considered, in as great detail as space permits, the potentialities of tropical Australia. Speaking generally, it is a pastoral land, almost the whole of which can be used in normal seasons for the rearing of stock. Only in the inland portion of West Australia is there an area (about 150,000 square miles) which seems to defy permanent occupation—even when the subartesian waters shall have been properly utilized.

CLASSIFICATION OF AREAS AS REGARDS FUTURE SETTLEMENT

So far as future settlement is concerned, we may classify tropical Australia in six divisions, of which four are pastoral and two agricultural. They are shown in Table III (see Fig. 22).

TABLE III—LAND CLASSIFICATION OF TROPICAL AUSTRALIA

	CLASS	APPROXIMATE LIMITS	APPROXIMATE AREA
A	Desert area	Between the tropic and Sturt's Creek	150,000 sq. mi.
B	Arid pastoral land	Carnarvon, Broome, and Boulia (excluding A)	300,000 "
C	Good pastoral land	Broome, Port Darwin, and Camooweal	280,000 "
D	First-class pastoral land	Camooweal to Barcaldine	170,000 "
E	Eastern farming area	East of 145° E. longitude	146,000 "
F	Northern coast lowlands	Victoria River to Cooktown	114,000 "

The greater part of class A can support no population at all.

Much of class B can only be lightly stocked and is liable to periods of prolonged drought, so that the human settlement depending on the pastoral industry in the southwest inland portion of the tropics does not offer much hope of becoming anything but negligible. It resembles the grazing country of Arizona, the southern Sahara, and Rajputana. In spite of much larger populations in the vicinity none of these arid regions have been able to support more than a sporadic settlement.

The White Australia policy prevents the profitable use of the denser populations of western Rajputana for comparison, and the same remark applies to the southern Sahara.

We may, however, look to a time when the more favorable areas of Australia begin to reach the density of similar regions in the United States. In such circumstances the arid lands of the tropics may reach the density of those in Arizona, which even now support less than one person to the square mile. As in Arizona, there are valuable mineral deposits in the arid tropics, but mining never leads to close settlement in the same way as farming. Thus in all the "non-agricultural" mining fields of Australia, it has been calculated, there are probably only about 120,000 inhabitants.

With regard to class C—good pastoral lands receiving from 15 to 30 inches of summer rainfall—there is no doubt that it will ultimately support a large population. It contains, however, much cereal and forest land, so that the figure is too high for the Australian region if it depends wholly on pastoral returns. Apparently no other dry, hot lowlands are occupied by a European (or half-caste) race. In Rajputana the density is about 50 to the square mile, mostly congregated in the wetter eastern portion. Jeypur, with 20 inches of rainfall, has 175,000 inhabitants. We may safely assume a density of one white to the square mile when the wetter portions are growing millet, pulses, etc., as it is possible they will in the future.

The country in the east of the pastoral belt (D) rejoices in a more constant rainfall. Much the same regions will serve as homoclimes as for class C. We may reasonably expect two or three persons to the square mile.

As regards the agricultural and neighboring districts in eastern Queensland (E), their nearest homoclime (as described) is the eastern coast of India. This is largely peopled by Dravidians, whom some authorities classify as a black race. We shall do better to investigate the conditions in eastern Brazil—where there is a region with rainfall of similar amount and character (along the Bahia coast) in latitude 10° S.

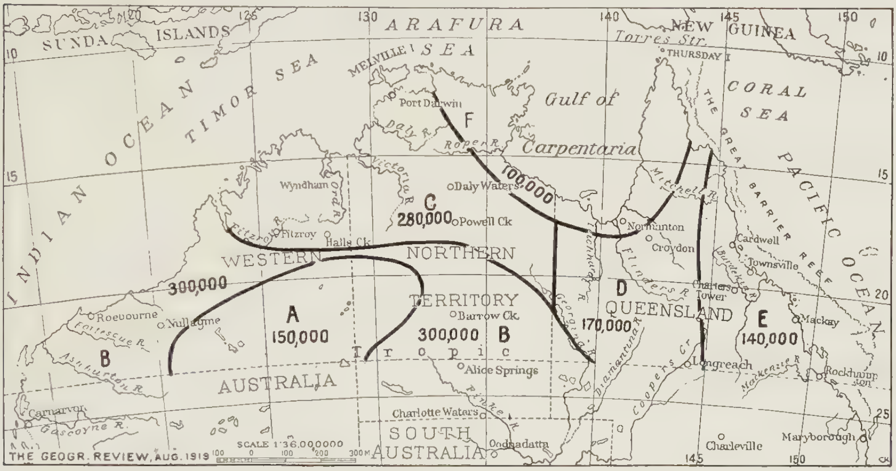

FIG. 22—Major economic provinces of tropical Australia. The boundaries are only approximate Figures represent square miles.

The inhabitants are largely Indian (i. e. Mongolic), negro, and southern European, with various half-castes, and total about 2,000,000, or about 12 to the square mile. Recent immigrants to Brazil total about 3,000,000, about equally divided among Spaniards, Italians, and Germans. The Germans have settled in the temperate regions of Rio Grande do Sul, which is a homoclime of Brisbane. The Italians colonize São Paulo on the tropic, and the Spaniards have spread through neighboring provinces. Few have entered the country which in any way resembles our northern coast lands, so that the South American experience is not hopeful for close white settlement north of latitude 15° S. Bahia and Cooktown have about the same average temperature of 76° F., and this line of evidence seems to point to their being the northern limits of important white settlement.

With regard to the narrow northern coast lands (F), where there is a copious summer rainfall and a possibility of irrigation, we have seen that many valuable products are grown in the somewhat similar regions of Madras, Bangkok, etc.

But there seem to be no regions of such uniform heat and low elevation that are settled by white farmers, and the prospects of this being done in Australia are very slight.[6] Two factors alone suffice to render such close settlement improbable. These are the large areas of cooler country which will long await settlement, and the enviable conditions attending manual labor in the rest of Australia.

It is unnecessary to discuss the effect on these lands of more frequent communication (whether by rail or sea, or of possible markets in the south or east, or of fostering bonuses, or even of mechanical cultivation. Probably none of these can overrule the fundamental law controlling settlement—that no one will occupy distant and unfamiliar regions who can gain a satisfactory living under more attractive circumstances.

Hence, we may conclude that close white settlement is impossible under present conditions. No estimate of the future population of this type of country (F) can, therefore, be given.

Other possibilities—not contravening the White Australia policy—are outlined in a previous section.

Factors Controlling Future Settlement

A logical conclusion to the presentation of the resources of the tropics given in this paper is to plot the assets in the various regions, so as to obtain a sort of contour map in which the various contours (or "isoiketes") represent degrees of habitability.[7] It is believed that the map constructed to this end will be of value even though it depends largely on the personal equation of the investigator.

TABLE IV—Relative Importance of Factors Controlling Settlement

	Factor	Tentative weight
A	Temperature (including elevation)	15 per cent
	Rainfall (including humidity)	15 "
	Metals	10 "
	Coal	10 "
B	Agriculture	15 "
	Pasturage	5 "
	Timber	10 "
C	Communications (steamer, rail, etc.)	5 "
	Present population	5 "
D	Health	10 "

In the first place, we have to determine the factors controlling settlement, their order of importance, and the weight to be assigned to each of them. The ten factors enumerated in Table IV will be admitted by everyone to be important.

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[6] The Official Report for the Territory for 1917 states that there are only ten agricultural settlers on the land.

[7] A new term is needed in economic geography to express such lines of equal habitability. "Isoikete" (from οἰκητός, habitable) is suggested.

Now we have to apply these factors to each of the various regions. How important is temperature (or rainfall, or metals, etc.) in controlling settlement?

It is to be noted that we are not asking, What is the chief control in each region? Hence we must be prepared to give pastoral potentialities a very small place, even though they are the most promising features of the tropics. Thus the farms of the Herberton district, or the coal of the Clermont district, must lead to a much larger population than the grazing of the Victoria River, valuable though it may be; and the former are to be weighted accordingly.

Temperature and rainfall are the fundamental controls and so must be mentioned separately, although their control is also indirectly included in the factors agriculture, timber, etc.

Criticism can be leveled at every one of these weights; but probably any common-sense scheme of weighting will lead to much the same arrangement of isoiketes as is shown in Figure 23.

In Table V the factors controlling settlement, enumerated in Table IV, are applied to the natural divisions of tropical Australia, as outlined in Figure 2. Some one region can usually be found to have been marked with the maximum for any given factor. Thus Atherton comes nearest ideal circumstances in many of the factors, such as rainfall, temperature, agriculture, and health. The Peak Ranges region contains good coal, which

TABLE V—TENTATIVE SCALE OF SETTLEMENT FACTORS

	SEE FIG. 2	TEMP. 15	RAIN 15	METALS 10	COAL 10	AGRIC. 15	PASTURE 5	TIMBER 10	RAILWAY 5	POPULAT. 5	HEALTH 10	TOTAL
COAST LANDS:												
W. A. West coast	a	7	7	7	0	2	2	1	2	1	3	32
North coast	b	5	10	0	2	2	2	3	2	1	3	30
N. T. West coast	c	5	8	7*	2	4	2	3	2	1	3	37
North coast	d	5	8	1	0	4	2	3	1	..	3	27
W. Gulf coast	e	5	10	0	0	4	2	2	2	..	4	29
Q. S. Gulf	f	6	10	0	0	3	3	2	2	1	4	31
E. Gulf	g	6	8	0	0	4	1	2	1	..	3	25
Townsville	h	8	10	7	2	8	3	10	4	3	3	58
Fitzroy	i	9	12	10	3	10	5	9	5	4	6	73
W. PENEPLANE:												
W. A. Kimberley	j	5	10	6	0	2	3	3	2	..	4	35
Sand Ridge	k	8	6	2	0	0	1	1	1	..	3	22
Pilbarra	l	6	6	7	0	0	2	2	2	1	4	30
N. T. Tanami	m	7	6	5	0	0	1	1	..	..	3	23
Macdonnell Ra.	n	9	7	5	0	2	3	1	1	..	4	32
UPLANDS:												
N. T. Victoria River	o	7	10	4	0	4	5	2	1	..	4	37
Arnhem	p	7	9	3	0	2	2	2	1	..	3	29
Central	q	8	9	2	2	3	2	2	2	..	5	35
Frew	r	9	8	4	0	0	3	2	1	..	6	33
Barkly	s	9	9	0	0	4	5	2	1	..	5	35
Q. Boulia	t	9	7	0	0	0	4	1	2	..	5	28
Selwyn	u	8	8	6	0	2	5	3	3	2	6	43
Winton	v	9	9	2	0	2	5	5	3	2	7	44
E. HIGHLANDS:												
Q. Peninsula	w	7	10	6	2	4	3	5	3	1	4	45
Atherton	x	12	15	10	4	12	5	8	4	3	9	82
Hughenden	y	10	12	4	4	4	5	8	4	3	8	62
Peak Ranges	z	11	13	7	8	10	5	8	5	2	8	77

* Including most of Pine Creek mines.

is indicated, and the Townsville division contains valuable softwood forests. Health is judged from the climographs and from prevalence of disease, etc. Places having good railway communication are ahead of those served by steamers, and the latter are better than the inland localities, such as Tanami, with no regular traffic.

The totals given in the final column are plotted on the regions shown in Figure 2, and lines (isoiketes) are drawn through those regions exhibiting equal values. We thus obtain Figure 23, which presents several interesting features.

There is a center of great potentiality along the eastern Queensland highlands and a center of low potentiality in West Australia. Another low area seems to surround the Gulf of Carpentaria. A tongue of favorable country extends from Queensland across to the Kimberleys, which certainly indicates that the railway should traverse the Barkly region rather than the center of the continent. The isoiketes are very crowded in the Peninsula—showing a rapid deterioration in values as we proceed from Herberton to the Gulf.

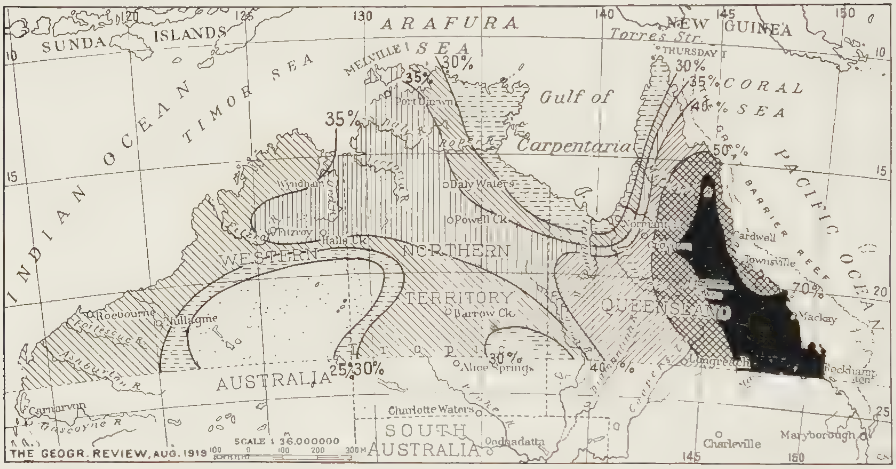

FIG. 23—Potentialities of moderate settlement in tropical Australia. The maximum (black) represents perhaps six people to the square mile. The minimum (dotted) has no possibilities of moderate settlement. The figures are percentages, where the maximum (100) represents an area with all the advantages described in the text. The distribution lines have been termed "isoiketes".

ULTIMATE POPULATION

It is almost impossible to give concrete figures to these areas. We may assume that the black region will ultimately support from four to eight people to the square mile, on the analogies already considered. We may be sure that the dotted area will never reach one to the square mile under present methods of world settlement, for no similar region anywhere has an important population.

Although the absolute values are doubtful, we may assume that the values shown by the isoiketes are substantially in the right order. Indeed, we may hazard absolute values. Thus, if the isopleth 80 (not shown in Fig. 23) be taken to represent about eight to the square mile and the isopleth 35 to represent about one to the square mile, for reasons already given, we get the empirical values given in Table VI.

TABLE VI—Estimated Future Population

Lines of habitability	Approx. density	Approx. area	Estimated future population
80 per cent isoikete	About 8 per sq. mi.	12,000 sq. mi.	100,000
70 " "	" 6 " "	90,000 "	500,000
50 " "	" 3 " "	90,000 "	250,000
40 " "	" 2 " "	150,000 "	300,000
35 " "	" 1 " "	250,000 "	250,000
			1,400,000

This figure of 1,400,000 people refers to a future period when the whole of the good pastoral country of the tropics shall be far more closely settled than is, for instance, central Queensland at present (see Fig. 24). It is no utopian forecast but calls for much more advanced cultivation and grazing methods than have hitherto been necessary to secure satisfactory returns. Probably a century or more will pass before this condition is reached.

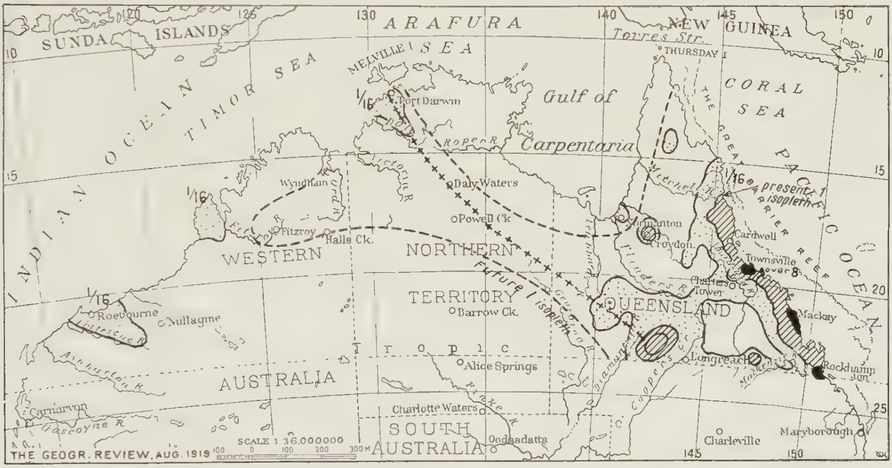

Fig. 24—Present population (based on Knibbs). Dotted areas have over 1/16 person to the square mile; ruled areas over 1 person to the square mile; black areas over 8 persons to the square mile. It is suggested that the one-person area will ultimately increase to the broken line. (The natural land route to Port Darwin is shown by crosses).

To ensure these results one cannot suggest any royal road. The eastern portion (east of long. 145°) would seem to be progressing steadily through private enterprise. But in the western and central portions the improvement (in part by public moneys) of transport facilities by permanent waterways, by stock routes, by light railways, and, in fact, by every method that will convert these regions into fully developed pastoral holdings cannot be too strongly insisted on. To an impartial observer, the needs of mining men and the doubtful problems of tropical white agriculture should be left to a later date—if the Commonwealth's aim be to establish settlement rather than to grow rich speedily.

THE SECOND THULE EXPEDITION TO NORTHERN GREENLAND, 1916–1918

Among the twentieth-century Arctic explorers the name of Knud Rasmussen is one of the best known. Half Eskimo, half white, he has known how to travel and live in the native way as no other man has learned it except Stefánsson. His second "Thule" expedition, just completed, is worthy of the first. On this journey, in 1912, he had established the connection of Peary Land with the main mass of Greenland by explorations at the head of Independence Fiord on the eastern side of northern Greenland.[1] *To reach the head of the fiord he had crossed the entire breadth of Greenland over the inland ice.*

On the present journey Rasmussen accomplished the equally bold feat of skirting the margin of northwestern Greenland, partly along the land fringe, partly on the inland ice. He penetrated deep fiords under extremely hazardous conditions of travel, with little game to be found, and returned to Etah in a starving condition, having lost two of his men—one, Olsen, by accident, and another, Dr. Wulff, through starvation.

The information that he was able to gather on this last journey about Eskimo migrations and on the physical and plant and animal geography of the coast is worthy of a place beside the best researches in Polar exploration. A summary of the results was published in the Geografisk Tidskrift *of Copenhagen (Vol. 24, 1917-18, No. 6, pp. 215-232) and is here translated and condensed by the editors for the* Geographical Review. *The present article contains the narrative of the expedition; a second article, to appear in the next issue, will deal with the scientific results.*

NARRATIVE OF THE EXPEDITION

By KNUD RASMUSSEN

The Second Thule Expedition[2] started April 1, 1916, from Copenhagen on the steamship *Hans Egede* for the purpose of carrying out one of two projected plans: (1) the examination and mapping of the large fiords on the northern coast of Greenland or (2) the examination and mapping of Melville Bay. By staying longer in Greenland than intended the expedition succeeded in carrying out both projects.

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[1] Knud Rasmussen: Report of the First Thule Expedition, 1912, *Meddelelser om Grønland*, Vol. 51, No. 8 (pp. 285-340), Copenhagen, 1915 (reviewed in the *Geogr. Rev.*, Vol. 2, 1916, pp. 65-66; see also the article "The Non-Existence of Peary Channel" in the *Review*, Vol. 1, pp. 448-452).

[2] A preliminary note, by W. E. Ekblaw, on the Second Thule Expedition appeared in the September, 1918, *Review*, p. 286.—Edit. Note.

Exploration of Melville Bay

The expedition went ashore at Godthaab on April 18. While the airline distance from there to Melville Bay is only 11 degrees (64° N. to 75° N.) the unfavorable ice conditions lengthened our actual voyage to nearly 2,250 kilometers. The journey was made by boat and sledge. It was hard going in northern Greenland on account of the mild winter and an early spring which resulted in our having neither real winter ice nor open water. For long distances there was great difficulty with the sledges. With the help of buoys these were made amphibious so that they might float in case the ice broke around them, as often happened. Because it was necessary to reach Melville Bay while winter ice was favorable, the march was forced day and night. By June 4 we reached Devils Thumb in Melville Bay.

We spent two weeks, June 4 to June 17, in examining Melville Bay. The members of the expedition who took part in this work were: Lauge Koch, cartographer and geologist; the Greenlander Tobias Gabrielsen, who had been a member of Captain Koch's sledge journey to the northern point of Greenland on the *Danmark* expedition; and the writer, as leader and ethnographer.

Lauge Koch succeeded in mapping Melville Bay completely in its whole extent of about 500 kilometers, while I made a thorough examination of the earlier conditions of habitation, locating more than 50 house ruins. Detailed maps were made of the most important settlements, and measurements taken of the better conserved houses and graves. In order to prevent destruction, warm water was used to uncover objects. The examination of the settlement conditions of Melville Bay procured much material that will be of value in understanding the Eskimo migrations to southern Greenland along this trail.

Local Ethnological Investigations

From July 1 to October 1 various local investigations were carried out by Peter Freuchen, Lauge Koch, and myself in the environs of Thule (on North Star Bay, Wolstenholme Sound). At a later time data will be produced relating to all the old settlements from Cape York to Etah. Koch and Freuchen have made a detailed map of the largest of these settlements, Umanaq in Wolstenholme Sound, that shows about 60 house ruins, a number of graves, many tent rings, meat caches, etc. Many of the ruins were measured.

With the aid of Captain Comer, of the Crocker Land Expedition, a large kitchen-midden was dug out in Umanaq. At the bottom of this was uncovered a layer of whalebone, which proves that the Greenland whale had formed what might be called a culture-base, that has become extinct and even forgotten.

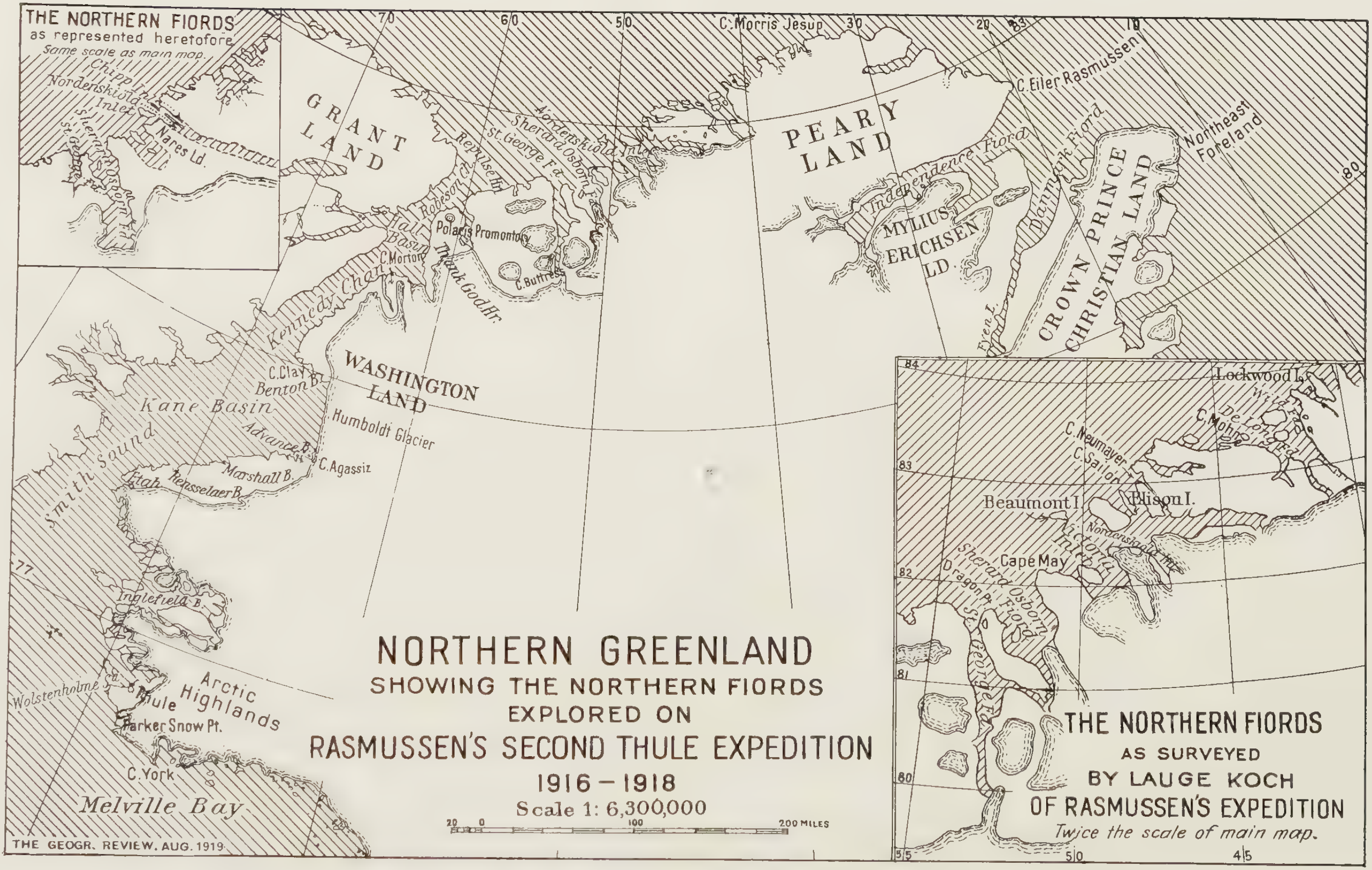

FIG. 1—(For the newly explored parts based on a map by Koch accompanying the article cited in the text.)

The Northerly Expedition: Its Organization and Objects

In October, 1916, after the ice had settled, several journeys were made to Melville Bay for the purpose of supplementing the map and ethnic material obtained on the spring journey. But the main object of the expedition was the sledge journey to the northern coast of Greenland, to the large fiords and to Peary Land. This was accomplished from April 6, 1916, to October 20, 1917.

The Second Thule Expedition, like all my earlier voyages, was a "hunting expedition" on which the food had to be procured by hunting, emergency rations only being carried. This I was able to do because of the experience I had gained in 1912 in the Nabo districts on the eastern side of Greenland. I counted especially on seals in the large fiords and musk-oxen on the extensive upland which, on American maps,[3] was shown about the fiords. Eskimos who had traveled with American expeditions at the mouths of the fiords which we wished to enter had informed me that the ice conditions there allowed one to count on seals in June and July. This and my own experience led me to believe that hunting would enable one to prolong a stay. On the upland were musk-oxen also, a circumstance which had enabled Peary in 1900 to save the lives of his comrades by a single hunt near Cape Wohlgemuth.

The members of the more northerly expedition were:

Thorild Wulff, botanist
Lauge Koch, geologist and cartographer
Inukitsoq, Eskimo hunter
Ajągo, Eskimo hunter
Nasaitordluarsuk, called "Boatman," Eskimo hunter
Hendrik Olsen, South Greenlander, late member of the *Danmark* expedition of 1906-1908
Knud Rasmussen, leader and ethnographer.

It was planned: (1) to map the large hitherto unexamined fiords: St. George Fiord, Sherard Osborne Fiord, Victoria Inlet, Nordenskiöld Inlet, Chipp Inlet, and De Long Fiord; (2) to make a botanical and geological examination of these districts, the most northerly land on earth; (3) to make an ethnographical examination of traces of an earlier Eskimo migration northward around Greenland to the eastern coast.

All these objects were accomplished. Very important geological and botanical collections were brought home, and the ethnographical examination failed to disclose any signs of an earlier settlement.

From Thule to the district of our work is more than 1,000 kilometers. In order to cover this ground as quickly as possible, we started with large and strong teams, a total of 6 sledges and 72 dogs. On the first part of the journey extra sledges were employed to carry the heavy narwhal and walrus meat to be used as provision for us and the dogs until we reached Nordenskiöld Inlet. Like my first expedition this was organized entirely in Eskimo style and based on their technique of journeying. Stress was laid on ammunition and whaling and sealing gear. Nearly 130 pounds of pemmican were destined merely for use on the return trip over the inland ice.

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[3] The standard representation is: Baffin Bay to Lincoln Sea, Polar Regions, showing the recent discoveries by Civil Engineer R. E. Peary, etc., 1:1,400,000, U. S. Hydrographic Office Chart No. 2142, Washington, 1903.—Edit. Note.

At the start of the expedition we had 27 sledges and 354 dogs, which were gradually sent home when the amount of provisions and dog food diminished. The last extra sledges left us as far up as Hall's grave near Thank God Harbor.

From Thule to Sherard Osborne Fiord

We started from Thule on April 6 and on April 22 we had already passed Humboldt Glacier and reached Washington Land. At Cape Morton, 81° N., we found an old depot of the *Discovery,* Nares' expedition ship. This depot, abandoned in 1875, consisted of 56 two-pound tins with fresh mutton which we enjoyed very much.

From May 2 to May 6 we traveled around the sharp northwestern corner of Greenland through large ice masses, over which we had to make our way with the help of ice-picks. At Repulse Harbor we found a cairn established by Peary in 1900. On May 7 we reached Dragon Point at the mouth of St. George Fiord. A cairn was found here that contained a detailed account by Beaumont, the first explorer in this region. It was dated May 25, 1876. There we placed a depot consisting of 50 pounds of pemmican, 50 pounds of biscuits, 30 pounds of rolled oats, coffee, tea, and sugar, to be used on our return from St. George Fiord. Near Sherard Osborne Fiord we found much deep snow, as was the case later in every fiord we came to. From here the expedition had to travel on foot for several months, as travel with dogs was impossible.

The Northern Fiords

When we reached the large fiords, where our work was to begin, we discovered that the land which was supposed to exist around Victoria Inlet and Nordenskiöld Inlet did not exist at all. This meant that we should not have the expected hunting. We therefore killed half of our dogs as soon as we could afford to do so. On May 19 we observed the first seal on the ice near Dragon Point. This assured us of good hunting, if only we could get ahead far enough during the spring. The work to be accomplished by the expedition required not only time, but also the coming of summer. When mapping the large fiords we had to skid ahead through snow, though this snow had to melt before we could do our botanical work. But even as late as July 1 we were able to proceed only with the help of snowshoes.

From May 8 to June 22 the large fiords from Sherard Osborne Fiord to De Long Fiord were mapped, though we were all the time fighting for food; and from May 6 to July 1 we waded in snow and during July in water, up to the knees. We were convinced that a longer stay here must be disastrous, but all the members agreed to take the risk rather than turn southward with only half our task accomplished.

Only in very few places on the entire journey did we find favorable musk-ox hunting. In a few valleys between Cape May and at the mouth of Victoria Inlet we shot 40 musk-oxen. The great difficulty of traveling with loads prevented us from carrying the musk-ox meat with us. It was only valuable to us in so far as we could eat it on the spot. At all other places on the northern coast we hunted in vain for musk-oxen. Sometimes we shot hare and grouse. But it was difficult to feed our dogs, now numbering 20, which were necessary to draw our collections and provisions.

Long hunting trips were without any results. We should have been obliged to sacrifice our dogs very early, had we not now and then captured a seal. Three of these we discovered at an open stretch or ''lead'' extending 30 kilometers inside Chipp Inlet, and two others we shot between Cape Neumayer and Cape Mohn. This made it possible for us to map De Long Fiord from June 20 to June 23. This fiord had three main arms, of which the most easterly was the longest. At their heads lies a high, ice-covered upland, where it is not possible for big game to exist. With the mapping of this very interesting fiord the expedition succeeded in proving that no channel exists leading from here toward Independence Fiord in the direction of the formerly supposed Peary Channel.

Results of Our Surveys

Here, at the ''farthest north'' of the expedition, we will briefly sum up the most important cartographical and geographical results. A comparison of the accompanying sketch map (Fig. 1) with the previous representation of the region (see upper left inset, Fig. 1) shows the following: a large ice-free land around St. George Fiord and ice-covered districts in the direction of Peary Land—exactly the opposite of what was before believed to be the case. So the large ice-free districts around Victoria Inlet and Nordenskiöld Inlet must be eliminated from the map, as the districts shown on the earlier maps as Nares Land are inland ice. Chipp Inlet, which was supposed to run parallel to Nordenskiöld Inlet, does not exist; but north of Nordenskiöld Inlet is a new fiord extending eastward for about 50 kilometers into Peary Land.

Nordenskiöld Inlet, which was believed to form the mouth of the so-called Peary Channel leading to Independence Fiord, proved to be a short fiord, only 20 kilometers long, the head of which ends in a glacier. If Peary believed he was looking into a deep channel, then he made a mistake, which could easily have occurred in passing the fiord at sea, as Peary did. From the outer coast near Cape Sailor one really seems to be looking into a large fiord, because the glacier that forms the head of the fiord is continuous with the fiord ice, and the nunatak hills at the fiord head appear to be a continuation of the land at the mouth of the fiord.

Victoria Inlet also has been taken to be a deep fiord that reached far into the ice-free land. Here, just as in Nordenskiöld Inlet, we have inland ice continuing the sea ice, and, when seen at a distance, this gives rise to incorrect inferences. The head of Sherard Osborne Fiord likewise consists of flowing inland ice, the so-called *sikûssak,* which ascends gradually and ends at the ice cap near Cape Buttress. This flowing inland ice overthrows all the earlier theories that there existed here the means of subsistence for the Eskimo. The manner in which this has affected the problem of migrations around northern Greenland will be treated in detail at another time.

The Return

On our return trip, June 26 to June 30, we managed to kill nine seals near Cape Sailor (Elison Island). Thus we had food for ourselves and our dogs before we started on the march through water and melting ice to Sherard Osborne Fiord, where we expected to find favorable conditions for seal-hunting. For twelve hours a day during one month we were wet up to our waists, but we had to go on, because St. George Fiord was the only place where we could ascend the inland ice. In order to preserve our collections and films from destruction by water, we had to build platforms on our sledges. The ice of Sherard Osborne Fiord was in splendid condition, and only when we had to go ashore, near Dragon Point, to fetch provisions from the depot for our return trip, did we observe that the abundance of melted ice during the last three weeks had caused a wide belt of open water to form between the land and the fiord ice. In this water were all the seals; but they did not come upon the ice as they are in the habit of doing everywhere else in Greenland at this time of the year. There was no use shooting them in the water because they went down like stones when hit.[4] Thus we managed to kill but two seals in a region in which we had expected to have the best hunting before we came to the inland ice. On land, near the place where we ascended the inland ice, we found only now and then a wolf, and these never came within the range of our rifles.

Death of Olsen

The expedition was now to lose the Greenlander Hendrik Olsen, who perished through unknown circumstances on a hare-hunting trip 20 kilometers south of Dragon Point on July 21. After waiting and searching four days in vain, we continued our journey, to stop again for twelve days 35 kilometers distant from the place where we should have met Hendrik. On the 24th we agreed that it was impossible to stay longer at that place, where we were unable to find food for ourselves and our dogs. Cairns were placed at three different locations containing letters, maps, clothing, and provisions.

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[4] In this connection it is interesting to refer to the section on "Hunting Seals in Open Water" in Stefánsson's article in the May *Review* (Vol. 7, 1919), pp. 301-302 and Figs. 6 and 7.—Edit. Note.

We can only guess the manner in which Hendrik perished. He may have drowned in a river or may have shot himself accidentally by falling into a crevasse or may have been attacked while asleep by a wolf, of which we observed a great many in this region. We were all very much moved by the loss of our dear comrade, and, before we left St. George Fiord, we built a cairn at which I made a speech in Danish and Greenlandish.

Dearth of Food

To add to the depression caused by the loss of our friend came other obstacles of a serious nature. We were starving in a deserted region where storms, rain, and thickening snow hindered our march to the inland ice, whence we were to start our journey homeward. We were able to find food from day to day, but there remained the problem of procuring reserve provisions for our long march over the inland ice, the shortest route and the only one possible for the transport of our scientific collections. It would have been impossible to carry them south over the snowless and rough coastland.

To be sure we had a few portions of meat left from our successful hunting near Cape May and the two seals we shot in St. George Fiord, besides 48 pounds of pemmican, about 40 pounds of biscuits, and about 20 pounds of rolled oats, coffee, and tea. But we starved in order to save our provisions for the journey over the inland ice. Though we killed a few dogs we had fourteen left for the two sledges.

The distance we had to cover over the inland ice to the nearest land south of Humboldt Glacier was 435 kilometers, which would not have been difficult had we been in good form with sufficient provisions. We had pemmican, biscuits, and rolled oats for 16 days on half rations. The seal meat and musk-ox meat that should have been our food we had to use to feed our dogs. In our run-down condition we did not wish to draw the sledges ourselves. The muscles of our legs were very weak from wading through ice-water during the month of June. Our meat, used as dog food, would last ten days, and, after our own provisions gave out, we could live on the dogs.

South Over the Inland Ice

On August 5 the weather became clear, and we started over the inland ice with all our materials and provisions stored on the sledges. Our hope of getting quickly to the land south of Humboldt Glacier was not realized, for after three days we came to a deep cleft, which we named "Djaevlekløften" (Devil's Cleft). It took us two days to get to the other side of this crack, formed by steep nunatak rocks. After another two days we arrived at a snowless plain, 20 to 30 kilometers in width, that reached from

St. George Fiord to Sherard Osborne Fiord and therefore could not be flanked. Again we lost two costly days by carrying our baggage and also the sledges to the main ice cap, which we reached on August 10. From then to the 21st we had easy going. We traveled as fast as we could and, in spite of being underfed, covered 35 kilometers daily on an average. On August 21, having eaten our last provisions, we sighted the land south of Humboldt Glacier 30 kilometers distant with still five dogs on which to subsist.

This was our position when in the afternoon there came a southwest wind with rain. Thereupon the ice broke up on the numerous rivers near Humboldt Glacier, and the streams became torrents. We fought these for four days. Tied to each other with seal straps, transporting our collections and materials over the slippery ground, we traveled by devious ways. Wading in wet clothes all day made us very weak, especially as we now lived only on dog meat, which was not very nourishing. Finally, on the evening of August 24, we reached Cape Agassiz, on the very day when we had eaten our last dog.

Arrival at Cape Agassiz

Our arrival here meant safety. The region is known to the Eskimos under the name Qaqaitsut, "the land without hills," and is visited every fall by reindeer and hare hunters from Etah and its environs. We observed quite a number of hare. Our three Eskimos went for a hunt, and Ajago returned after a few hours with five hare, while the other two Eskimos continued to follow the fresh trails of reindeer. Our fight for food seemed to be over, and now we had to get in communication with mankind as soon as possible. We had no clothing or ammunition for a longer stay, and had to be careful to reach in time the ship which we expected to find waiting for us near Etah.

We decided that Ajago and I, who were less weak than the others, should head for Etah, 225 kilometers distant, in order to organize a relief expedition. Both Wulff and Koch were in very bad shape, but we left with them two clever hunters, Inukitsoq and Nasaitordluarsuk, to provide food. The country here is made up of many rock hollows, cut by clefts and filled with small lakes. Since it would be difficult to find our friends in such a place, we decided that they should travel slowly forward to the large lake behind Marshall Bay, known to all Eskimos, where we could easily find them. Ajago and I left Wulff and Koch on August 25, before Inukitsoq and Nasaitordluarsuk had returned from their hunting trip.

Relief from Etah

We advanced with very little rest through difficult terrain about 150 kilometers, when, on the afternoon of the 29th, we met the reindeer hunter Miteq from Inglefield Gulf. It was no use returning to our comrades, as

Miteq had provisions for only two or three days and besides we might have missed our friends, as, according to our plans, they would have left our own camp going south. Therefore we did not change our plan, which was to procure effective help as quickly as possible from Etah. We reached Etah on the evening of August 30. During the night five relief sledges with plenty of provisions and necessities started for the rescue of our friends.

On the following day the sledges were on the inland ice and searched the large lake back of Marshall Bay. Here two cairns were to be placed, at which two men were to stay, while the other three should search the land farther north in special directions. The relief sledges found our comrades on September 4 after a two-day journey north of the large lake, but, to our great sorrow, too late to rescue Dr. Wulff, who had died under the terrible strain of the voyage. The death of our friend moved us very much. All of us, and especially Dr. Wulff, had been convinced that our arrival at Inglefield Land meant the rescue of the whole party.

DEATH OF DR. WULFF

But after Ajago and I had left Koch and Wulff, it developed that Dr. Wulff was much weaker than he appeared to be at our departure. He had always been in good condition, even when we lived on half rations, but when we had to use dog-meat as food, he grew weak. In spite of this I believe he would have pulled through, if he had not suffered from lack of blood in the brain and pains in the heart. Then he wrote his last letter to me and died. The letter, which I received through Koch, begins:

> My dear Knud,
>
> The unceasing hunger during the summer and the hardships of the last days have brought me down and taken all my energy, so I am unable to follow Koch and the Eskimo any longer. As their rescue depends on a quick advance to favorable hunting grounds, I should only be a burden. Therefore, in full possession of my faculties, I say good-by and thank you for your comradeship during the expedition. I hope that all of you, as well as the results of the expedition, may be saved.

These words may well serve as his own epitaph and may, together with his excellent botanical materials, preserve his name as long as there exists on earth an interest in solving scientific problems.

The relief sledges brought Koch, Inukitsoq, and Nasaitordluarsuk to the Eskimo settlement at Etah, where we remained in order to gain strength, so as to be able to continue our voyage in the course of the fall or winter to Holstenborg. Thence we intended to sail for home by the Royal Greenland commercial steamer *Hans Egede.*

CRETE AND ATLANTIS

By PHILIP COOMBS KNAPP

In the world-old antithesis between reason and imagination, between the poet and the scientist, there are those who still seek a sea coast in Bohemia, who still strive to fix the latitude and longitude of Prospero's enchanted isle, who still try to find Robinson Crusoe's cave and the footprints of Friday on Juan Fernandez. Their identification of Atlantis with some existing region seems equally visionary.

Plato's Description of Atlantis

Having depicted his ideal state in the "Republic," Plato, in his "Timaeus," goes on to show how his ideal state would conduct itself in some great struggle and, to this end, relates the tradition of the most famous ancient action of Athens, 8,000 years before—the overthrow of the island of Atlantis. There was a

> mighty power which was aggressing wantonly against the whole of Europe and Asia . . , an island situated in front of the straits which you called the columns of Heracles, . . . larger than Libya and Asia put together, and was the way to other islands; and from the islands you might pass through the whole of the opposite continent which was surrounded with true ocean; for this sea which is within the straits of Heracles is only a harbor . . . In this island of Atlantis there was a great and wonderful empire which . . . subjected the parts of Libya within the columns of Heracles as far as Egypt and of Europe as far as Tyrrhenia.

In the "Critias" Plato once more describes Atlantis as having been allotted to Poseidon, who begat several children by a maiden Cleito, living in a mansion there which he enclosed by "making alternate zones of sea and land larger and smaller, encircling one another . . . equidistant every way, so that no man could get to the island." After giving the names of all the children Poseidon had by Cleito and describing the great riches and abundant products of the land, animal, vegetable, and mineral, Plato describes the arrangement of the country.

> They bridged over the zones of sea which surrounded the ancient metropolis . . . and dug a canal of 300 feet in width and 100 in depth and 50 stadia in length which they carried through to the outmost zone, making a passage from the sea up to this, which became a harbor . . . Moreover, they divided the zones of land which parted the zones of sea, constructing bridges . . . Now the largest of the zones into which a passage was cut from the sea was three stadia in breadth, and the zone of land, which came next, of equal breadth; but the next two, as well as the zone of water as of land, were two stadia, and the one which surrounded the central island was a stadium only in width. The island in which the palace was situated had a diameter of five stadia.

Plato also gives in great detail the composition of the walls, the character and arrangement of the buildings, the nature of the country, the population, and the form of government. After Athens had defeated Atlantis the whole island was sunk by an earthquake which left "an impassable barrier of mud to voyagers sailing from hence to the ocean."

I have quoted liberally from Plato's description—which, as he gives it in the "Critias," is much more detailed and elaborate—in order to show the mathematical precision with which he describes the arrangement of Atlantis, resembling for all the world the encampment of the tribes of Israel about the tabernacle in twelve camps of precisely similar numbers, as given in the priestly code of the Pentateuch.

The Suggested Identity of Atlantis and Crete

Since Plato's day much search has been made for the site of Atlantis, in every part of the world—America, Palestine, Arabia Felix, Ceylon, Sardinia, and Sweden—but without avail. Of late years the suggestion has been made that the great Minoan Kingdom of Crete was the original of Atlantis. The suggestion, first made by an anonymous writer in an English newspaper, was further elaborated by Mr. James Baikie[1] and recently urged again by Mr. E. S. Balch.[2] Mr. Balch argues that Plato's descriptions might well apply to Crete, once a kingdom of great extent and power, which might readily have ruled over Libya and Europe as far as Tyrrhenia; that Athens and Egypt combined may have put an end to the Minoan Kingdom in 1200 B. C.; and that the tradition of the impassable seas may refer to the cessation of the commerce between Egypt and the Minoan Kingdom.

The cause of the downfall of the Minoan Kingdom remains unknown. It is probable that the destruction of the great palace at Cnossus was a sudden catastrophe and that the destruction of the kingdom was also sudden, possibly, as Mr. Baikie has suggested,[3] a sequel to the overthrow of the Minoan fleet, which for a very considerable period had ruled the waves of the eastern Mediterranean. Although the kingdom was destroyed, Minoan civilization continued to exert its influence throughout much of Greece and the islands of the Aegean. The Achaean invasion may have played some part in the overthrow of the Minoan Kingdom, but Minoan civilization dominated its conquerors. In fact the civilization of Mycenae is now regarded as chiefly of Minoan origin, and Minoan influences are traced even to the mainland of Asia Minor. There is some slight tradition as to the *débâcle* of the Minoan Kingdom, but none as to any physical catastrophe such as destroyed Atlantis, nor is there any geological record pointing in that direction. Furthermore, in the traditional history of Greece, after, of course, the great "matter of Troy," the "matter of Crete" assumes a place second only to the "matter of Thebes." For some reason, too, the expansion of Greece for many years was toward the east, to Troy and Ionia; perhaps, as Mr. Leaf thinks, on account of the power of the Kingdom of Taphos (Corfu).[4]

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[1] James Baikie: The Sea-Kings of Crete, London, 1910, pp. 256-259 (reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 44, 1912, pp. 282-283).

[2] E. S. Balch: Atlantis or Minoan Crete, *Geogr. Rev.*, Vol. 3, 1917, pp. 388-392.

[3] *Op. cit.*, p. 176.

The Implications of This Theory Not in Accord With Tradition

This theory, that the Minoan Kingdom was Atlantis, seems to demand that the Minoan Kingdom was absolutely destroyed and that memory of it faded away from the mind to such an extent that the possibility of a visionary Atlantis may have replaced it. That the memory of it did so disappear is not borne out by what little we know of the traditions of the period. The dates of the Minoan catastrophe and of the fall of Troy are so vague that we know not which came first; but Crete was still well known to Homer, whose date, uncertain as it is, was certainly later than the sack of Cnossus.

> And of the Cretans Idomeneus, the famous spearman, was leader, even of them that possessed Cnossus and Gortys of the great walls, Lyctus and Miletus and chalky Lycastus and Phaestus and Rhytium, established cities all; and of all others that dwelt in Crete of the hundred cities. Of these men was Idomeneus, the famous spearman, leader, and Meriones peer of the man-slaying war god. With these followed eighty black ships—

a number second only to those that followed Agamemnon. So says the Catalogue of Ships; but elsewhere in the Iliad also Idomeneus holds no contemptible position as a leader, and a part of the Thirteenth Book is devoted to his valor and exploits.

The fame of Idomeneus is not unknown to Hesiod, who has various references to Crete and the extent of the Kingdom of Minos. Similar references may be found also in the Homeric hymns and the Epic cycle.

It was some time after Homer's day that the Mycenaean civilization, with which he was familiar and which was an outgrowth of the Minoan, disappeared under the great northern invasion, and the dark ages of Grecian history begin. That the Hellenic and Athenian civilizations which followed were essentially different is now conceded, but we know little of their origins. It is possible that during this period, some five hundred years after the great Minoan catastrophe, the memory of Crete grew less; but the poems of Homer remained, and Hellenic civilization assumed to be descended from the Homeric age and clung to its traditions and teachings.

Cretan Tradition in Greek History and Literature

Even apart from Homer, however, the Cretan traditions were still preserved. The Greek tragedians, to be sure, made no use of the "matter of Crete" in their extant tragedies; but the historians touch upon matters of Cretan history not mentioned by Homer. Herodotus tells us that the grandson of Minos (Idomeneus?), in defiance of warnings, joined the expedition to Troy and that, in consequence of his absence, his kingdom was invaded and destroyed. Thucydides, as keen an exponent of the influence of naval supremacy as Admiral Mahan, alludes to the fact that Minos was the first to establish it when by his fleet he had made the seas safe against the pirates.

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[4] Walter Leaf: Homer and History, London, 1915; see especially pp. 171-192.

In Greek literature, as it has come down to us, the "matter of Crete" for some reason was never made the special theme of poet, dramatist, or historian. The references to it which we find are merely *obiter dicta,* allusions by writers whose main subject was something different. Enough has come down, however, to show that, so far from Crete and the Minoan Kingdom having faded from human memory to be replaced by a vague tradition of Atlantis, trustworthy traditions of the great Minoan Kingdom reached the age of Pericles almost a thousand years later and must have been known to Plato.

As to the possibility that Athens took part in the attack on Crete, as she is said to have attacked Atlantis, we must be more than skeptical. According to Homer, the part that Athens took in the Trojan War was insignificant; and the history of Athens before and after this war is veiled in obscurity.

Improbability of This Theory

Assuming, however, that we had no record of Crete after the fall of Cnossus and that the memory of the Minoan Kingdom had faded utterly from the Greek mind, it is hardly probable that Crete was cut off from all communication with the mainland as was Atlantis. It is not unlikely that, after the great sea fight that must have preceded the destruction of Cnossus, Minoan commerce was destroyed and piracy revived; but not long afterward navigation itself revived. Soon after the Trojan War the Greeks began their eastward migrations, colonizing the Ionic cities in Asia Minor. Phoenicia was journeying westward at least to Tarshish and Gades, if not outside the Pillars of Heracles; and later still Greece began to plant colonies in Marseilles and Syracuse. With such extensive movements of the nations in the Mediterranean it is hardly possible that they could have passed by Crete, ignoring its existence. Indeed, tradition tells us that after the destruction of Cnossus the northern tribes began to occupy Crete.

The "Timaeus" is, in a way, a continuation of the "Republic." There Plato had described his ideal state. He goes on in the "Critias" to describe a state laid out with wonderful exactness and regularity—a state that seems, from the fragment, to be literally as utopian as his Republic. He is rather fond of references to Egypt. Phaedrus says to Socrates: "You can easily invent tales of Egypt," and so Plato ascribes the origin of this imaginary island of Atlantis to a tale of Egypt.

GEOGRAPHICAL RECORD

NORTH AMERICA

Present Immigration into the United States. The "Annual Report of the Commissioner General of Immigration for the Fiscal Year Ended June 30, 1918" (Bureau of Immigration, U. S. Dept. of Labor, Washington, D. C., 1918), presents official statistics showing how completely the great migratory movement to America has been checked and also gives some interesting figures regarding the elements that continue to arrive. The immigration into the United States, whose annual average for the decade immediately preceding the war was 1,218,480 persons, has been reduced to the relatively insignificant number of 110,618. The recent restrictive legislation has consequently had little opportunity for operation, though it did account for a slight decrease, 7,297, or 3.3 per cent, of the applicants for admission being rejected, 23 per cent of these owing their exclusion to the new law. The above figures actually represent little addition to the permanent population of the country, since during the year 94,585 aliens emigrated, 14 of the 40 nationalities listed showing a greater number of departures than arrivals, the net gain being only 16,033. Taken as a whole the number of immigrants was the lowest since 1844, with the one exception of the year 1862, when only 72,183 arrived.

Though obviously it would be unsafe to draw conclusions regarding the future of immigration, either as to its numbers or its racial characteristics, from the statistics for the past few years, which merely reflect the abnormal conditions existing both in America and abroad, yet it is of interest to note that during 1918 the countries from which the greatest numbers of persons arrived in the United States were the following: Great Britain, Mexico, Japan, Scandinavia (including Denmark), and Spain. In the excess of arrivals over departures (leaving out of account the so-called non-immigrant and the non-emigrant, i. e. travelers, temporary residents, etc.) a different order of races and nationalities is noticeable. Here the Japanese, with an excess of immigrants over emigrants of 8,610, were in the lead; followed by Africans (black) with 4,415; Scandinavians with 4,076; and Spaniards with 3,727. On the other hand, among the 14 nationalities whose emigration exceeded immigration (again excluding non-emigrants and non-immigrants) the following led: Mexicans with an excess of departures over arrivals amounting to 7,482; Russians with 3,413; and Italians (South) with 2,901.

That approximately the same general situation has prevailed during the nine months from July, 1918, to March, 1919, is revealed in the *U. S. Immigration Service Bulletin* for May 1, 1919. According to statistics there published the British again led in immigration arrivals, having already passed their numbers for the preceding year. The Japanese have not quite equaled their former rate. Mexicans have slightly surpassed their total for the year 1918, and far fewer Mexicans have emigrated (judging from the number of aliens who have crossed the international boundary southward), thus making the gain apparently more permanent. The total number of permanent immigrants arriving in these nine months was 91,200, while 63,144 aliens permanently emigrated from the country, leaving an increment of 28,056.

The Cold Winter of 1917-18. The remarkably severe winter of 1917-18, with its "record-breaking" low temperatures at many stations and its serious economic effects, especially in connection with the transportation of coal in the northeastern sections, will not soon be forgotten. It was our "war winter" in more aspects than one. Mr. Preston C. Day of the Weather Bureau considers the contributing factors concerned in the development and the continuance of the extreme cold in a recent number of the *Monthly Weather Review* (Vol. 46, 1918, pp. 570–580). In December practically the whole of the North American continent was controlled by an extended area of high pressure central north of the Arctic Circle and accompanied by great cold. Northerly and northwesterly winds prevailed over the United States east of the Rocky Mountains, bringing persistent cold, while warm, generally southerly and southwesterly winds prevailed to the west. An unusually deep and extensive snow cover over much of the eastern United States was an additional factor in producing the extreme cold. During January pressure was below the normal over the southern and eastern sections, with a resulting flow of cold air from the north. This air, passing over the nearly universal cover of snow and ice, kept the temperatures very low. It is Mr. Day's opinion that, given favorable pressure distribution, lasting a sufficient length of time, colder weather is possible than that which characterized the winter of 1917-18, ''without any change in the orderly procession of the forces dominating our weather.''

February, 1918, was marked by a uniform prevalence of southerly winds east of the 100th meridian, as a result of which unusual warmth persisted during much of the month. This milder weather brought much relief to transportation and mining interests and also relieved the widespread suffering and discomfort which had resulted from the scarcity of coal and of other fuels.

Mr. Day's article is illustrated by numerous charts showing temperature and pressure distribution and also contains references to some of the many striking economic aspects of the generally severe cold and also of the unusual warmth which characterized certain sections of the country. R. DeC. Ward

An Ecological Survey of the Palisades Interstate Park. It is one of the attractions of New York that there are so near it thousands of acres of rough, rocky land for the most part covered with forest. Probably no other large city in the world has so large an acreage of forests conveniently located as a resort for its people. There has now been published a note on an ecological survey of the Palisades Interstate Park by Dr. Charles C. Adams (*Empire Forester*, Vol. 5, 1919, pp. 12-18, Syracuse, N. Y.), which suggests the manner in which it can best be improved and used. Palisades Park is a narrow strip on the western side of the Hudson reaching from New York to near West Point and westward to the Ramapo River—in all about 35,000 acres of forest. It is chiefly mountain land with clearings in the valleys. Ponds and lakes have been enlarged, roads and trails constructed, and mountain outlooks made. During the summer of 1918 nearly 50,000 people camped in the park on an average of ten days each. In order best to improve the Park special studies have been made of the bird life, the fish, and the forest botany. The results of these studies are to be published in popular form and will make excellent excursion guides to stimulate and direct intelligent interest toward both scenic beauties and wild life.

War Activities of the Blue Hill Observatory. In the annual volume containing the ''Observations and Investigations Made at the Blue Hill Meteorological Observatory'' for 1918 reference is made, for the first time publicly, to the part which that observatory took in American scientific activity in connection with the war. Near the beginning of the year the Director, Professor Alexander McAdie, was asked by the Navy Department to serve as senior aerographic officer and to undertake the organization of an aerographic service in connection with naval aviation, both in this country and abroad. Professor McAdie, commissioned as Lieutenant Commander in the United States Naval Reserve Force, was sent overseas in April, 1918, with a small group of junior officers who had been trained at Blue Hill. During the year 56 candidates for commissions received instruction at the observatory, 28 American universities or colleges being represented in this number. As the Director says in his introduction to the 1918 volume: ''It is a memorable tribute to the far-sightedness of the founder of the observatory that, when the country needed an institution where men might be given opportunity to study the structure of the atmosphere and become familiar with the working of instruments similar to those in the leading European observatories, the need could be promptly met.'' R. DeC. Ward

EUROPE

Publications on the Military Geography of the Italian Front. As a result of the struggle in which Italy was engaged along her northeastern border during the war, and as an aid in carrying on the military operations in that region, the Comando Supremo of the army issued a series of pamphlets dealing with the military geography of particular points along the frontier. Several of these studies are of decided general geographical interest, as will be seen from the subjects listed below. They cover such matters as the topography, hydrography, temperature at different elevations and different seasons, roads, vegetation, wind direction, humidity, rainfall, snowfall, the danger from avalanches, water supply, the strategic features of the mountains, and relate to such now famous places as the Piave basin, the Asiago plateau, the upper and middle Adige, the upper Isonzo, Monte Nero, the Bainsizza plateau, Il Montello, the basin of Gorizia, etc. Detailed topographic maps, reprints of those made by the Istituto Geografico Militare, accompany some of the pamphlets, while others contain profiles, hypsometric maps and sketches of the topographic features.

AUSTRALASIA AND OCEANIA

Australian Exploration and Its Physiographic Relations. The exploration of Australia was guided by physiographic conditions and climate, and the conflicting reports of the explorers affected outside opinion in a constantly changing manner. The continent has its fertile portion so disposed that even today most of its people live in a narrow band within a comparatively short distance of the sea. The great interior is either quite desert or primarily a stock country. About 1,000,000 square miles, or one-third of the whole, offers only poor support to flocks and herds. This great area has probably less than 150,000 cattle and sheep or not much more than one per cent of the total stock of the commonwealth. Dr. Griffith Taylor, Physiographer of the Commonwealth Weather Service, has recently published (*Geogr. Journ.*, March, 1919) a valuable analysis of the routes of the explorers in terms of climate and physiography. He discusses all the earlier explorations, including those of Capt. Jansz (1606), Houtman (1619), Carstens (1623), Thyssen (1627), all of whom visited peculiarly inhospitable stretches of coast. The desert thickets, the dry offshore trade winds, the old state of native life, the sterile soil, made a most unfavorable impression.

Tasman was the first circumnavigator of Australia and was the first to visit portions of the country which exhibited other aspects than barren wastes and stunted vegetation. From that time on, explorers' comments on the nature of the land varied with the region visited, and their testimony was conflicting and on the whole affected British readers unfavorably. Cook, in 1770, visited the eastern portions, where the rainfall is heavier, and his report was distinctly favorable. On those portions of the coast discovered by the English are sixty-four of the eighty largest towns in Australia today. Of all the coast explored by the Dutch only a small region (Swanland) is suited for white settlement. The first settlement was made in 1788 on the shores at the fine harbor of Port Jackson, one of the greatest harbors in the world, where there were rich valley lands and bordering cattle pastures. There follow notes on the work of the explorers who penetrated inland, like Cunningham (1823-1827), Hume and Hovell in 1824, and the noteworthy explorations of Mitchell and Sturt, who explored especially the drainage of southeastern Australia from 1830 to 1836. It was in 1836 that settlement was first started in South Australia and exploration proceeded rapidly from Adelaide. Eyre saw Lake Torrens in 1838, a lake which occupies a rift valley of fairly late origin, and in 1841 the same explorer started on his disastrous journey to the Swanland region. In northeastern Australia memorable work was done by Kennedy, who passed along the deeply dissected, eastward-facing scarp fronting the Pacific, where, on account of the heavier vegetation and rugged relief, his expedition met with constant difficulties and dangers. Only by 1862 was the whole of Australia fairly well known, and even then the varying accounts of rainfall and suitability for settlement made scientific exploration a necessity. The contradictory reports are due largely to the unreliability of the rain. One explorer visited a region in a wet year, when there are good pastures, and another visited the region in a very dry year. Only the rather permanent vegetation and the minor surface features, such as sand hills, shallow depressions, and mountains are described in terms that agree in all the accounts.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

UNITED STATES

South-Central States

GITTINGER, ROY. **The formation of the state of Oklahoma (1803-1906).** 256 pp.; maps, bibliogr., index. *Univ. of California Publs. in History,* Vol. 6, 1917. University of California Press, Berkeley. 9½ x 6½.

Though the author of this volume has made no attempt to treat his subject from a geographical viewpoint, in fact usually seems unconscious of the geographical factors that entered into the development of Oklahoma, yet such factors cannot be hidden. They obtrude themselves continually. In each stage of the state's evolution from wild prairie to well-settled commonwealth the influence of topography, river routes, mountain passes, climate, or soil is apparent. Such detailed accounts form an excellent basis for the application of geographical principles.

This work is of peculiar value since it is not limited to Oklahoma alone but describes the political development of the state as an integral part of the great Southwest. The Louisiana Purchase; the formation of Missouri Territory (1812); the migration of Indian tribes from east of the Mississippi and their settlement in the old Indian Territory (then comprising a large part of what is now Kansas, Nebraska, and Colorado); the sweep of white settlement across the prairies; the creation of Kansas and Nebraska out of that larger Indian Territory; the struggle for slave and free states; the Indian's part in the Civil War; and finally the gradual infiltration of whites into the lands allotted to the various Indian tribes, resulting in the spectacular opening up of Oklahoma to settlement and the formation of the present progressive commonwealth—each of these stages is fully described.

Besides being a comprehensive story of Oklahoma's growth into statehood, the work will serve as a guide to the sources of her history and will be of high value to other students in the same field. The author has drawn largely upon the treasure house of United States government documents, as was, of course, necessary since Oklahoma has been until recently under federal control. He has also collected the scattered material in periodical literature and particularly in historical society publications of neighboring states. Thus Professor Gittinger has written a volume which will undoubtedly remain a standard reference work for the history of the state.

MATTESON, W. G. **A review of the development in the new central Texas oil fields during 1918.** Maps, ills., diagr. *Econ. Geology,* Vol. 14, 1919, No. 2, pp. 95-146. Lancaster, Pa.

SOUTH AMERICA

ECUADOR, PERU, BOLIVIA

PERRIER, G., edit. **Mission du Service Géographique de l'Armée pour la mesure d'un arc de méridien équatorial en Amérique du Sud, sous le contrôle scientifique de l'Académie des Sciences, 1899-1906. Vol. 2, Part I: Atlas. Introduction générale aux travaux géodésiques et astronomiques primordiaux de la Mission. Notices sur les stations.** 27 pp.; maps. Ministère de l'Instruction Publique, Paris, 1913. 11 x 9.

As a result of proceedings initiated at the meeting of the International Geodetic Association in 1889 the French Government undertook the measurements of a new meridian arc in the highlands of Ecuador (see G. W. Littlehales. The Recent Scientific Missions for the Measurement of Arcs of the Meridian in Spitzbergen and Ecuador, *Bull. Amer. Geogr. Soc.,* Vol. 39, 1907, pp. 641-653). The expedition was in the field from 1901 to 1906 and, besides executing its primary object, was also able to make studies in the natural history, ethnography, and anthropology of the region. Results have been published as they have been worked up. The last part that has appeared up to date, and one of the most interesting geographically, is the atlas of topographic surveys and plans. The observers at the triangulation stations were required to construct topographic surveys of their surroundings with a twofold object in view—for reconstruction of the site of the station and for study of the gravity action due to the mountain masses in the vicinity of the stations. Of the 78 stations of the first order the present atlas includes surveys of 41; twenty of the remainder will be included in the more extended surveys which will appear in the volume (not yet published) devoted to detailed triangulation of the region (for plan of triangulation see that accompanying the article by Littlehales).

The other volumes or parts of volumes that have already appeared are: Vol. 3, Part I, Angles azimutaux (1910); Part II, Compensation des angles, calcul des triangles (1912); Part VII, Latitudes astronomiques observées aux théodolites à microscopes (1910); Vol. 6, Ethnographie ancienne (1912); Vol. 9, Zoologie, Part I, Mammifères, oiseaux, trochilidés (1911); Part II, Reptiles, poissons, batraciens (1911); Part III, Mollusques, annélides, oligochètes (1910); Part IV, Actinies (1910-1912); Vol. 10, Entomologie, botanique, Part I, Hyménoptères, orthoptères, nevroptères, araignées. Vol. 6, Ethnographie ancienne, has been analyzed by Pierre Denis in *Ann. de Géogr. Bibliogr. Géogr. Annuelle* for 1912.

Brazil

Cherrie, G. K. **From Central Matto Grosso overland to the coast.** Map, ills. *Bull. Pan Amer. Union,* Vol. 46, 1918, No. 6, pp. 759-771. [A short note on a trip over the railroad recently constructed to Corumbá.]

Crandall, Roderic. **Notes on the geology of the diamond region of Bahia, Brazil.** Map, diagrs. *Econ. Geology,* Vol. 14, 1919, No. 3, pp. 220-244. Lancaster, Pa. [Containing some topographical description of the region.]

Farabee, W. C. **A pioneer in Amazonia: The narrative of a journey from Manaos to Georgetown.** Map, ills. *Bull. Geogr. Soc. of Philadelphia,* Vol. 15, 1917, No. 2, pp. 57-103. [Abstracted in the *Review,* Vol. 4, 1917, pp. 397-398.]

Giglioli, Italo. **Italiani e tedeschi nel Brasile; i Valdesi nell' Uruguay: Euconomia più che economia.** 29 pp.; bibliogr. Reprint from *L'Agricoltura Coloniale,* 1917, November 30. Florence. 9½ x 7.

Kappetein, P. C. **Bevolking en economische ontwikkeling van Brazilië.** *Tijdschr. voor Econ. Geogr.,* Vol. 8, 1917, No. 7, pp. 209-219.

Martin, P. A. **The influence of the United States on the opening of the Amazon to the world's commerce.** *Hispanic Amer. Hist. Rev.,* Vol. 1, 1918, No. 2, pp. 146-162. Baltimore.

Morize, H., and H. F. da Silva. **Results of geographic and magnetic survey of the southern part of Brazil, 1913-15.** *Terrestr. Magnet. and Atmosph. Electr.,* Vol. 21, 1916, No. 3, pp. 147-149.

Mossman, R. C. **Notes on the climate of the state of São Paulo, Brazil.** Map. *Quart. Journ. Royal Meteorol. Soc.,* No. 189, Vol. 45, 1919, pp. 53-63. London.

Mossman, R. C. **The rainfall of Fortaleza, Ceará, Brazil.** Diagr. *Quart. Journ. Royal Meteorol. Soc.,* No. 189, Vol. 45, 1919, pp. 69-79. London.

—— **Paraná, Geologia do Estado do.** Ills., bibliogr. *Bol. Minist. da Agric., Indust. e Commerc.,* Vol. 5, 1916, No. 1, pp. 67-143. Rio de Janeiro.

Pinto, E. R. **The Indians of Serra do Norte, Matto-Grosso, Brazil.** Map, ills., bibliogr. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 1, Section 1: Anthropology, pp. 358-362. Washington, D. C., 1917. [The Nambikuáras (Nhambiquaras). No reliable information on these Indians was obtained until Colonel Rondon's explorations in 1907. Later Colonel Roosevelt passed through the region. The author obtained there a great ethnographical collection in 1912.]

Rangel, Alberto. **Aspectos geraes do Brasil.** *Rev. Inst. Hist. e Geogr. Brasileiro,* Vol. 76, 1913, Part I, pp. 455-517. Rio de Janeiro, 1915.

Scherrer, Joseph. **Historisch-geographischer Katalog für Brasilien (1500-1908).** *Annaes Bibliotheca Nacl. do Rio de Janeiro,* Vol. 35, 1913, pp. 313-418.

Schuller, R. R. **A Nova Gazeta da Terra do Brasil (Newen Zeytung auss Presillg Landt) e sua origem mais provavel.** Map, ills. *Annaes Bibliotheca Nacl. do Rio de Janeiro,* Vol. 33, 1911, pp. 115-143.

STURZENECKER, G. R. **Contribuição para o estudo da orographia brasileira.** *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 310-318. Washington, D. C., 1917.

ZEHNTNER, LÉO. **Estudo sobre as maniçobas do Estado da Bahia, em relação ao problema das seccas.** 113 pp., map, ills. *Inspectoria de Obras Contra as Seccas Publ. No. 41.* Rio de Janeiro, 1914.

LANE, GUILHERME, AND VIRGILIO PINHEIRO. ***Mappa do Estado de Alagoas.*** 1:500,000. *Inspectoria de Obras Contra as Seccas Publ. No. 44.* [Rio de Janeiro,] 1917. [Relief in brown shading; distinction between perennial and non-perrenial streams. Railroads, telegraph lines, and roads shown.]

RICE, A. HAMILTON. ***Survey of the Rio Negro, from Manáos to São Gabriel, Jan.-Mar., 1917.*** 1:750,000. Accompanying the article "Notes on the Rio Negro (Amazonas)" by A. Hamilton Rice, *Geogr. Journ.,* Vol. 52, 1918, No. 4, pp. 205-218 (map opp. p. 276).

EUROPE

THE LOW COUNTRIES, LUXEMBURG

SCHRIJNEN, JOS. **Nederlandsche Volkskunde.** xx and 316 pp.; diagrs., index. W. J. Thieme & Cie., Zutphen, [1915?]. 3 fr. 75. 9½ x 7.

The author is a member of the faculty of the Government University of Utrecht, and this work is a compilation of the superstitions, racial differences, and racial characteristics of the inhabitants of the Netherlands and may be said to have attained the pinnacle of thoroughness. No single phase of the curious details of Dutch life is omitted by the author, and it must regretfully be stated that his tedious volume, while scholarly in the extreme and having all the earmarks of careful research, goes far towards defeating the object he hopes to attain, that is the awakening of an interest in the customs of his native land.

Dr. Schrijnen is careful to explain in his introduction that the English conception of the word "folklore" must not be applied to the Dutch word "Volkskunde." Even here his passion for details comes to the fore, and his reader has to wade through a complete biography of the abused word, beginning with an issue of the British *Athenaeum* for 1846 in which is found an article by Mr. Thoms of the Camden Society wherein the word "folklore" is first used, and ending with the founding of the London Folklore Society in 1877. From "folklore" Dr. Schrijnen, by easy stages, drifts to "Volkskunde," which can best be translated by "ethnology," until he concludes by giving his personal definition of the word used in the title of his work. This definition is as follows—and the translation is literal—: "a systematic, rational study of the basis of culture. It is the ethnology of cultured races." In consequence, such students as take the definition seriously will be forced to coin a new word when they deal with the "ethnology of *savage* races," and it might be interesting to know what Dr. Schrijnen's word for this would be.

While "Nederlandsche Volkskunde" is more than tiresome, one has to pay a tribute to its author for the care with which he has compiled his information. To students of native games, for example, his classification of and exhaustive data on games of all kinds must prove of the greatest aid for purposes of reference. His chapter on the religious and heathen superstitions of all parts of the Netherlands is also exhaustive, and he traces back many of the old jingles and festive songs to their remote ancestry, thereby giving his reader a curious insight into the different races which went to make up the people of the Netherlands. In matters like these the book has decided merit; and, as the author has added a complete index, the volume will probably often be used for reference.

It would seem well-nigh impossible for Dr. Schrijnen to find enough material in the Netherlands of the kind included in this first volume to fill his promised second one, even though he mentions in his introduction that it will contain an "ethno-geographical chart in which the distribution of some folkloristic [the author's word] boundaries (dialects, place names, types of farmhouses, etc.) is indicated by decided lines, in order to see what results one can attain towards a more intimate knowledge of the racial division of the Netherlands."

THEODOOR DE BOOY

BEEKMAN, A. A. **De stormvloed van 13-14 Januari 1916.** *Tijdschr. Kon. Nederl. Aardrijk. Genoot.,* Vol. 33, 1916, No. 3a, pp. 364-394.

BELLOC, HILAIRE. **The significance of Ardennes.** Maps. *Land and Water,* No. 2941, Vol. 71, 1918, Sept. 19, pp. 3-6. London.

BLANCHARD, RAOUL. **L'origine des moëres de la plaine maritime de Flandre.** *La Géographie,* Vol. 31, 1916-17, No. 5, pp. 337-342. Paris. [*Moëres*=meres, marshes.]

BLINK, H. **Economische geographie der Provincie Overijsel.** Maps. *Tijdschr. voor Econ. Geogr.,* Vol. 7, 1916, No. 3, pp. 89-128; No. 8, pp. 395-404. **De economische ontwikkeling van Overijsel in de laatste eeuw,** *ibid.,* No. 9, pp. 427-441. **Ontwikkeling der nederzettingen in Overijsel als economische centra,** *ibid.,* No. 10, pp. 478-490. The Hague.

BONGAERTS, M. **De kanalisatie van de Maas en haar economische gevolgen.** *Tijdschr. voor Econ. Geogr.,* Vol. 7, 1916, No. 1, pp. 5-14. The Hague.

DEMANGEON, A. **Anvers.** *Ann. de Géogr.,* No. 148-149, Vol. 27, 1918, pp. 307-339. [A study of its geographical *raison d'être.*]

LORIÉ, J. **Geologische beschouwingen over het eiland Voorne.** Map, diagrs., bibliogr. *Tijdschr. Kon. Nederl. Aardrijk. Genoot.,* Vol. 34, 1917, No. 6, pp. 781-799.

MASSART, JEAN. **D'où vient la flore du littoral belge?** Map, diagr. *Ann. de Géogr.,* No. 137, Vol. 25, 1916, pp. 321-327. [The coast of Belgium, being of recent origin, affords a good field for the study of plant migration. The author's conclusion is that the Belgian species came from the south rather than from the north. A map, 1:25,000,000, of the vegetational regions of the greater part of Europe accompanies the paper.]

RUTGERS, H. **Daalt of rijst de bodem van Nederland?** *Tijdschr. Kon. Nederl. Aardrijk. Genoot.,* Vol. 34, 1917, No. 4, pp. 467-480.

—— ***Ypres area, Map showing progress in the.*** 8th edit. 1:40,000. *Geogr. Sect. Genl. Staff* [*Map*] *No. 3588.* Ordnance Survey, [Southampton], Nov., 1917. [Relief in contours (interval 5 meters) and supplemental brown tints for 30-40, 40-50, 50-60, and above 60 meters. Lines of Allied advances from June 12 to November 17, 1917, shown in blue; also German trenches and other military works in red.]

BALKAN STATES, INCLUDING RUMANIA

GRAVIER, GASTON. **Les frontières historiques de la Serbie.** Preface by Émile Haumant. 164 pp.; maps. Librairie Armand Colin, Paris, 1919. 4 fr. 9 x 5½.

At the time of his gallant death at the front in 1915 Gaston Gravier had two major works in hand, the one on the natural regions of Serbia, the other on the territorial formation of the Serbian state (*Ann. de Géogr.,* Vol. 24, 1915, p. 456). The latter was completed save for a final revision and has now been published under the above title. Its primary interest is expressed in the author's own words (p. 4): "Serbia offers perhaps the most representative example of the type of state which has arisen and developed in that ill-defined, ill-differentiated zone where contact is established between two worlds profoundly different in race and civilization."

ALMAGIÀ, ROBERTO. **Tracce glaciali nelle montagne dell'Albania.** *Riv. Geogr. Italiana,* Vol. 25, 1918, No. 3-4-5, pp. 85-95. Florence.

BARNES, J. S. **The future of the Albanian state.** Map, ills. *Geogr. Journ.,* Vol. 52, 1918, No. 1, pp. 12-30 (discussion, pp. 27-30). [Part I is concerned with boundaries: "The first and fundamental principle here to be taken into consideration in the task of boundary delimitation is that of nationality, which in the case of Albania happily coincides with race and language"; Part II deals with the political future.]

DENIS, E. **La grande Serbie.** xiii and 336 pp.; maps, index. Librairie Delagrave, Paris, 1915. 3 fr. 50. 7 x 4½.

FAUCHER, D. **Contribution à la détermination des niveaux lacustres de la basse vallée du Vardar.** *Comptes Rendus de l'Acad. des Sci.* [*de Paris*], Vol. 168, 1919, No. 9, pp. 462-464.

FAUCHER, D. **Le Tikvès̆.** *La Géographie,* Vol. 32, 1918, No. 4, pp. 226-230. Paris. [The ancient lake bottom occupying the angle between the Vardar and the Cherna in Macedonia.]

MUZET, ALPHONSE. **Le monde balkanique.** 314 pp.; map. Ernest Flammarion, Paris, 1917. 3 fr. 50. 7 x 5.

NEWBIGIN, M. I. **The problem of the South Slavs (Yugoslavs).** Ills. *Scottish Geogr. Mag.,* Vol. 35, 1919, No. 1, pp. 1-15.

NIOX, GENERAL. **Les pays Balkaniques.** 2nd edit. vi and 188 pp.; index. Librairie Delagrave, Paris, 1915. 2 fr. 50. 7 x 4½.

SUGAREFF, V. K. **The Bulgarian nationality of the Macedonians.** *Journ. of Race Devel.*, Vol. 9, 1919, No. 4, pp. 382-393. Worcester, Mass.

TAÜBER, C. [*sic*, i. e. TÄUBER, C.] **La mia traversata delle Alpi albanesi settentrionali.** Ills. *Riv. Mensile Club Alpino Italiano*, Vol. 35, 1916, No. 2, pp. 47-53; No. 3, pp. 81-85; No. 4, pp. 111-117. Milan.

WARING, L. F. **Serbia.** With a preface by J. M. Jovanovitch. 256 pp.; map, bibliogr., index. (Home University Library.) Henry Holt & Co., New York, 1918(?). 7 x 4½.

—— ***Europe, International map,*** 1: 1,000,000. Sheet: ***North K 35, Istambul (Constantinople).*** Layered. Boundary revised Nov. 1918. *Geogr. Sect. Genl. Staff* [*Map*] *No. 2555.* War Office, London, 1918.

AFRICA

SOUTH AFRICA

MOLSBERGEN, E. C. G. **Reizen in Zuid-Afrika in de Hollandse tijd. Vol. 2: Tochten naar het Noorden 1686-1806.** xxxvii and 310 pp.; map, ills., bibliogr., index. (Werken uitgegeven door de Linschoten-Vereeniging, Vol. 12.) Martinus Nijhoff, The Hague, 1916. 10 x 7.

The Linschoten Society, founded in the Netherlands ten years ago, has most energetically carried on its purpose to print important and hitherto unpublished records of early travel by Dutch explorers. Its publications, thus far, embrace Dutch travels in the Arctic and the East Indies; Roggeveen's circumnavigation of the world from east to west in 1721-22, during which he discovered a considerable number of Pacific islands; the explorations of de Vries in parts of Europe and America; researches on the Guinea coast; and two volumes on the early Dutch expeditions into the interior of South Africa. In this, the second volume of the South Africa travels, we see the Dutch afield to the north of the Orange River, both in the interior of the continent and along the west coast as far north as Walfish Bay. The explorers found that both the giraffe and the elephant were already retreating to the north of the Orange River, as the natives who hunted them had been strongly reinforced by Dutch sportsmen.

The volume is well illustrated by clear and graphic drawings and a map of South Africa in the early days of its exploration. The work of the Linschoten Society, in rescuing from oblivion the important records it has thus far published, deserves the hearty appreciation of all geographers. CYRUS C. ADAMS

ALMEIDA D'ECA, VICENTE. **The economic resources of the territories of the Companhia do Nyassa.** *Trans. 3rd Internatl. Congr. of Tropical Agric. Held at the Imperial Inst., London, June 23-30, 1914*, Vol. 2, pp. 504-525. Internatl. Assoc. for Tropical Agric., London, 1917.

BEATTIE, J. C. **Further magnetic observations in South Africa during the years 1913-1915.** *Trans. Royal Soc. of South Africa*, Vol. 5, 1917, Part VI, pp. 669-670. Cape Town.

BLAAUW, F. E. **Waarnemingen op het gebied van dierengeografie in Zuid-Afrika.** *Tijdschr. Kon. Nederl. Aardrijk. Genoot.*, Vol. 33, 1916, No. 6, pp. 890-903.

COX, G. W. **The intensity of rainfall in the Transvaal.** Map, diagrs. *South African Journ. of Sci.*, Vol. 12, 1915-16, No. 13, pp. 686-693. Cape Town.

CRABTREE, W. A. **Lake Bangweulu and its inhabitants.** Ills. *Journ. African Soc.*, No. 63, Vol. 16, 1917, pp. 216-226. London and New York. [A review of the works of the Swedish ethnologist, Eric von Rosen: Från Kap till Alexandria (Stockholm, 1912) and Träskfolket: Svenska Rhodesia-Kongo-expeditionens etnografiska forsknings resultat (Stockholm, 1916).]

DU TOIT, A. L. **The zones of the Karroo system and their distribution.** Map. *Trans. and Proc. Geol. Soc. of South Africa*, Vol. 21, 1918, pp. xvii-xxxvi. Johannesburg. [Presidential address at the annual meeting, March 21, 1918.]

EVANS, M. S. **The natives of Natal in relation to the land.** *South African Journ. of Sci.*, Vol. 15, 1918-19, No. 4, pp. 235-246. Cape Town. [A study of land tenure.]

Goold-Adams, Hamilton. **South-Central Africa.** 26 pp.; maps, ills. Reprinted from *Truth*, 1915, Sept. 19. Royal Geogr. Soc. of Australasia, Queensland. [Brisbane.]

Hall, A. L. **Asbestos in the Union of South Africa.** 152 pp.; map, diagrs., ills., bibliogr., index. *Geol. Survey of Union of South Africa Memoir No. 12.* Pretoria. 5s. 9½ x 6.

Hetherwick, A. **Nyasaland to-day and to-morrow.** Ills. *Journ. African Soc.*, No. 65, Vol. 17, 1917, pp. 11-19. London and New York.

Lacy, George. **South African exploration. Pioneer hunters, traders, and explorers of South Africa. The experiences of early travellers in Southwest Africa.** 28 pp. ("South Africa" Handbooks, No. 91.) Reprinted from *South Africa*, July, 1918. London. 6d. 6 x 5.

Legat, C. E. **Timber supplies and forestry in the Union.** *South African Journ. of Sci.*, Vol. 15, 1918-19, No. 2, pp. 79-99. Cape Town.

Mason, M. H. **The Transkei.** Map, ills. *Geogr. Journ.*, Vol. 52, 1918, No. 1, pp. 30-43 (discussion, pp. 41-43).

Phillips, E. P. **A note on the flora of the Great Winterhoek Range.** *South African Journ. of Sci.*, Vol. 15, 1918-19, No. 4, pp. 226-234. Cape Town. [A study of the vegetation existing under mountain conditions.]

Range, Paul. **Ergebnisse von Bohrungen in Deutsch-Südwest-Afrika.** 137 pp.; map, ill. *Beiträge zur geol. Erforschung der Deutschen Schutzgebiete No. 11.* Berlin, 1915.

Rindl, M. M. **The medicinal springs of South Africa: Supplement I.** *South African Journ. of Sci.*, Vol. 15, 1918-19, No. 4, pp. 217-225. Cape Town. [The continuation of a paper with the same title which appeared in the June, 1917, issue of this journal.]

Rogers, A. W. **Namaqualand.** *South African Geogr. Journ.*, Vol. 1, 1917, No. 1, pp. 23-33. Johannesburg.

Sim, T. R. **The black wattle industry.** *South African Journ. of Sci.*, Vol. 13, 1916-17, No. 7, pp. 279-301. Cape Town. [In past years large quantities of the tanning material, black wattle bark, have been exported from Australia. Today a practical monopoly of the export is held by Natal, where, through an unusually fortunate combination of circumstances, the industry is in a flourishing condition. Climate, soil, and labor are all conducive to its success. Labor, cheap in Natal, is prohibitive in cost in Australia and New Zealand. Areas in the Cape otherwise suitable may better be devoted to cattle raising, as in the United States alfalfa and fruits are more profitable in the sections where climatic conditions are right for wattle cultivation. Heretofore the Natal bark has been exported overseas; now with the development of a South African meat export trade and opportunity for the scientific handling of hides the product may be used at home.]

Tönnesen, T. **The South-West Africa Protectorate.** Map, ills. *Geogr. Journ.*, Vol. 49, 1917, No. 4, pp. 282-300.

Wagner, P. A. **The mineral industry of the Union of South Africa and its future.** Map. *South African Journ. of Sci.*, Vol. 15, 1918-19, No. 2, pp. 45-78. Cape Town.

ASIA

Malay Archipelago, including the Philippines

Lee, J. C. H. **The manual for topographers: Philippine Department, United States Army, 1915.** 117 pp.; diagrs. *Occasional Papers No. 52.* Engineer School, U. S. Army, Washington Barracks, D. C., 1917. 9 x 6.

Military surveys in the Philippine Islands have been in operation almost from the beginning of the American occupation. Their object is to furnish reliable maps of all territory suitable for military operations in the archipelago. Geographical positions are referred to the Luzon datum of the Coast and Geodetic Survey. The main control is triangulation of tertiary or higher accuracy. A polyconic projection is used; scale 2 inches to 1 mile; contour interval, 20 feet. In trail work where limited topography is shown the scale is reduced to 1 inch to 1 mile, and in mountainous country the contour interval may be 100 feet.

In addition to explanation of the policy, organization, standards, and methods of the survey and its relations to the civil government, Captain Lee's manual includes care and adjustment of instruments, field triangulation, control traverses, needle traverses, differential leveling, azimuth, topography, the elevation datum, time, suggestions to computers, mess and ration accounts, sanitation, and definitions. Sample forms for all records are shown and in the appendixes are reproduced various necessary tables. JAMES GORDON STEESE

LEKKERKERKER, C. **Land en Volk van Sumatra.** x and 368 pp.; map, diagrs., ills., index. E. J. Brill, Leiden, 1916. 7.50 gulden. 10 x 7.

A few years ago the Royal Colonial Institute of the Netherlands offered a prize for the best handbook describing the resources and ethnology of the island of Sumatra, the Institute being desirous of calling the attention of the outside world to the growing importance and the latent possibilities of this westernmost outpost of the Dutch East Indian archipelago. This prize was awarded to Mr. C. Lekkerkerker, a former school inspector of the colonial government and the keeper of the archives of the Bali Institute.

There can be no doubt that the author's "Geography and Ethnology of Sumatra" is an exhaustive treatise. It bears all the earmarks of accurate and painstaking compilation. At times, in fact, the work becomes trite through its very completeness, and Mr. Lekkerkerker's many years of teaching appear to have tainted his spirit with a desire to drum knowledge into his reader's mind by constant repetition. No user of a geographical handbook can consider that his intelligence is being complimented when he has to wade through a lengthy description of the exact manner in which a mangrove tree spreads its roots and acts as a trap for alluvial river mud (p. 6), nor does he particularly care to be told that coconut shells, when filled with rain water, are a menace to public health because they offer a breeding place for the larvae of mosquitoes (p. 105).

Despite this drawback, the author has filled his handbook with valuable information. When one considers that at the present time Sumatra is cultivated only to the extent of two or three per cent of its area and could readily sustain twenty times its present population, it will be seen that this information may not come amiss to intending developers of the resources of the island. The petroleum deposits, the coal mines, the rubber lands, and many other possibilities are attractive openings for foreign capital cited by Mr. Lekkerkerker.

The author is happier in his ethnographic description of the island. The ethnological student finds much of interest. The enumeration and classification of the numerous tribes comprising the 5,000,000 inhabitants of Sumatra are not only of high value but are a pioneer effort at a systematic ethnological census of the indigenous races.

The author adds a brief résumé of Sumatra's history and settlement by white colonizers and gives an insight into the causes of the war between the Dutch government and the inhabitants of Atjeh, the northern part of the island.

A clear and excellent map of Sumatra (1:2,500,000) accompanies the volume. Two insets, one of the geological formation (1:7,500,000) of the entire island and one of the agricultural areas now under development on the eastern coast (1:1,500,000), are also especially good. THEODOOR DE BOOY

ABENDANON, E. C. **Historische geologie van Midden-Celebes.** *Tijdschr. Kon. Nederl. Aardrijk. Genoot.*, Vol. 34, 1917, No. 3, pp. 440-456; No. 4, pp. 548-564.

ANDERSON, ISABEL. **The spell of the Hawaiian Islands and the Philippines.** xiv and 373 pp.; maps, ills., bibliogr., index. (The Spell Series.) Page Co., Boston, 1916. $2.50. 8 x 5½.

BARTON, R. F. **Ifugao law.** 127 pp.; map, ills., glossary. *Univ. of California Publs. in Amer. Archaeol. and Ethnol.*, Vol. 15, 1919, No. 1. Univ. of California Press, Berkeley. 11 x 7. [This treatise consists principally of an ethnological study of customs among the Ifugaos, as related to their tribal law. These people, a Malayan hill tribe, inhabit an isolated section in the center of northern Luzon. They are a sedentary race, with a highly developed terrace agriculture and extensive irrigation for the cultivation of rice. Yet they have no political government, no officers of the law, no courts, no judges. Their social relations, tenure of property, and even financial dealings are regulated by custom, which is so strong and so universally complied with that they have long maintained a fair degree of order in their district without interference on the part of Spanish or American authorities.]

CHU, CO-CHING. **Some new facts about the centers of typhoons.** Diagr. *Monthly Weather Rev.*, Vol. 46, 1918, No. 9, pp. 417-419. Washington, D. C.

D'ALMONTE, ENRIQUE. **Formación y evolución de las sub-razas indonesia y malaya.** Diagrs., ills., bibliogr. *Bol. Real Soc. Geogr.*, Vol. 59, 1917, No. 1, pp. 7-109; No. 2-3, pp. 129-321; No. 4, pp. 398-478. Madrid.

HEISER, V. G. **American sanitation in the Philippines and its influence on the Orient.** *Proc. Amer. Philos. Soc.*, Vol. 57, 1918, No. 1, pp. 60-68. Philadelphia.

HOUWINK, L. **De artesische boringen in het bekken van Batavia.** *Tijdschr. Kon. Inst. van Ingenieurs Afdeeling Neder.-Indië*, 1914, No. 2, pp. 5-12. Batavia.

MAGALHAES, A. L. DE. **A ilha de Ataúro (Província de Timôr): Noticia sôbre a ilha e seus habitantes.** *Bol. Soc. de Geogr. de Lisboa*, Ser. 36, 1918, No. 1-3, pp. 53-70; No. 4-6, pp. 164-178. [Ataúro, usually called Cambing (or Kambing), is a small island lying just north of Timor in the Portuguese East Indies. The writer gives a description of the physical features of the island, its resources, people, etc.]

MOLENGRAAFF, G. A. F., AND OTHERS. **De geologie van het eiland Letti.** (Nederlandsche Timor-Expeditie 1910-1912.) Ills., index, bibliogr. *Jaarboek van het Mijnwezen in Nederl. Oost-Indië*, Vol. 43, 1914, Part I, pp. 1-232. The Hague.

—— **Philippine Islands, Report of the Governor General of the, to the Secretary of War, 1917.** iv and 188 pp.; index. Washington, D. C., 1918.

—— **Philippine Islands, The mineral resources of the, for the year 1915.** 39 pp.; map, diagrs., ills. Division of Mines, Bur. of Sci., Manila, 1916.

—— **Philippine Islands, The mineral resources of the, for the year 1916.** 31 pp.; maps, diagr., ills. Division of Mines, Bur. of Sci., Manila, 1917.

RABOT, CHARLES. **L'œuvre géographique des Néerlandais en Malaisie.** *La Géographie*, Vol. 32, 1918, No. 1, pp. 10-19. Paris. [A summary of recent work.]

SMITH, HARRISON W. **Sarawak: The land of the white rajahs.** Map, ills. *Natl. Geogr. Mag.*, Vol. 35, 1919, No. 2, pp. 110-167.

SMITH, WARREN D. **Geologic and physiographic influences in the Philippines.** Maps, ill. *Bull. Geol. Soc. of America*, Vol. 28, 1917, No. 3, pp. 515-542. [Physiographic conditions are invoked—here and there a little too plausibly—to explain human development. The response of Manila to its physical environment is especially worth noting. The city is built at a point where sea, plain, lake, and river are in juxtaposition, a combination rare in the islands. The Pasig River is the main artery to the rich lake country to the southeast. The plain affords not only excellent agricultural land but, built of alternating loose pyroclastics and shales, has an exceptionally good supply of artesian water. The bay, with narrow outlet and wide flaring interior, is one of the safest (from seismic disturbance) and best protected in the world. In its broader relations Manila also occupies an enviable position in the Orient, being in close touch with Malaya and midway between the rich plains of China and the growing continent of Australia.]

—— ***Coron Bay, Philippine Islands, Western entrance to.*** 1:50,000. *U. S. Coast and Geodetic Survey Chart No. 4350.* Washington, D. C., Jan., 1919.

—— ***Cuyo Islands, Philippine Islands, Anchorages in.*** (1) ***Cuyo Islands, Cuyo Anchorage, and Bisucay Channel,*** 1:10,000, from surveys of 1912; (2) ***Cuyo Islands, Tagauayan Islands,*** 1:10,000, from surveys of 1915. *U. S. Coast and Geodetic Survey Chart No. 4336.* Washington, D. C., Sept., 1918.

—— ***Cuyo Islands, Philippine Islands.*** 1:100,000. *U. S. Coast and Geodetic Survey Chart No. 4312.* Washington, D. C., March, 1918.

—— ***Shark Fin Bay to Flechas Point, Northeast coast of Palawan, Philippine Islands.*** [1:100,000.] *U. S. Coast and Geodetic Survey Chart No. 4317.* Washington, D. C., April, 1918.

AUSTRALASIA AND OCEANIA

AUSTRALIA, NEW ZEALAND

TAYLOR, GRIFFITH. **The Australian environment (especially as controlled by rainfall).** 188 pp.; maps, diagrs., bibliogr. *Commonwealth Advisory Council of Science and Industry Memoir No. 1.* Melbourne, 1918.

For no part of the world have we at the present time so clear, so practical, so complete, and so useful a series of climatological and meteorological studies as that which is available for the Commonwealth of Australia. Under the able direction of Mr.

Henry A. Hunt, Commonwealth Meteorologist, the Australian Bureau of Meteorology has issued a set of regular reports and of bulletins in which that bureau may well take pride and for which the climatologists of the world are under deep and lasting obligations. In recent years Dr. Griffith Taylor, physiographer in the Commonwealth Bureau of Meteorology, instructor at Melbourne University, and lecturer at the Commonwealth Flying School, has been especially active in presenting the larger facts, as well as the details, of Australian climatology and meteorology in an original and remarkably successful manner. In his latest publication on ''The Australian Environment'' he gives us a regional study of the topography, drainage, vegetation, settlement, and of the character and origin of the rains, which is not only indispensable to all who are in any way concerned with the region with which it deals, but may well serve as a model and as an inspiration for those who are attempting similar studies of other parts of the world. The appearance of this report at the present time is due to the generosity of the Advisory Council of Science and Industry in providing the money to have it printed.

''The Australian Environment'' is the third of a series dealing with the climatic control of settlement in Australia. The first was published in 1916, as *Bulletin No. 14*, ''The Control of Settlement by Humidity and Temperature'' (see *Geogr. Rev.*, Vol. 4, 1917, pp. 401-403, and Vol. 5, 1918, p. 86). The second, *Bulletin No. 11*, discussed the control exercised by rainfall and temperature on the three chief products of Australia—cattle, sheep, and wheat (see *Geogr. Rev.*, Vol. 1, 1916, p. 396). In this an estimate was made of the probable extension of these industries in the future.

The fundamental conception of the author in the present monograph is concerned with the rains of Australia. The sun causes migrations (''surges'') in the ''moisture belt'' of the atmosphere. This belt is broken into the various storm systems, which actually bring the different types of rainfall. A discussion of the topography and of its evolution is included for the reason that the surface features are largely the result of the action of the falling rain and of its consequent drainage and also, in their turn, control the general distribution of the rainfall. The natural vegetation depends primarily upon this rainfall and prepares the way for man's occupation. Finally, a study of man's experience in similar natural regions elsewhere leads to a summary of the industrial and hygienic aspects of the Australian region. This sequence of thought is the framework upon which the whole study is built up.

The sun being the fundamental control upon which all the other conditions depend, a simple, original, and very ingenious cardboard ''solar control model'' has been devised, which, when properly cut out and adjusted, shows, month by month, the winds, pressure, storms, and rains which prevail over Australia. The migrations of the tropical rain belt, and of the other varying atmospheric phenomena which oscillate in unison with the movement of the sun, are admirably shown by means of this model, which emphasizes, in a very striking way, the interdependence of meteorological phenomena. The centers of pressure and their accompanying winds swing slowly 1,000 miles north and the same distance south during the year, at the same time having a general west-to-east progression of about 400 miles a day. Dr. Taylor well points out that the former slow movement determines the *climate*, while the latter, with its local oscillations and stoppages, controls the *weather*.

A new and interesting chart is that which shows rain reliability (Fig. 5), on which are indicated the percentage variations from the normal annual rainfall (1891-1910). This shows where the rains are likely to agree with the average rainfall and is of great value in forecasting. By means of it the possibility of agriculture in various parts of the continent can be deduced. Another original map is that of the zones of rainfall uniformity (Fig. 7). This does not take account of fluctuations but of averages, the lines showing the number of months during a year which receive over one inch of rainfall. The area with over one inch of rainfall during 12 months is confined almost wholly to the southeast. These rainfall maps are directly followed by a vegetation map, based on the German map by Diels, a comparison of which with the preceding rainfall maps shows a remarkably close correspondence.

The ''climograph,'' previously discussed by Dr. Taylor in *Bulletin No. 14* of the Commonwealth Bureau of Meteorology (see this *Review*, Vol. 5, 1918, p. 86), is used to correlate the various types of Australian climate with those of other parts of the world, and deductions are made as to the probability of settlement of various districts by white men and as to the crops which are most likely to succeed. This is a practical problem of immediate and future economic and political importance in connection with the settlement of the tropical parts of Australia. A similar graphical method, named the ''hythergraph,'' enables one to study the distribution of plant life.

The last 150 pages of the memoir are taken up with detailed regional studies. The country is divided into fifteen major regions on the basis of rainfall. For each section there is a study of the physiography; vegetation; origin, distribution, and effects of the rains; health; economics, etc. These pages contain the first detailed study of the physiography of the whole of Australia and are accompanied by colored contour maps not previously published for most of tropical Australia. An outstanding feature of this regional discussion is the large series of weather maps, illustrating the various types of rains occurring in each section. We have never had a study of Australian rainfall types so complete as the present one. Mr. Henry A. Hunt's "Types of Australian Weather" (1896) was, however, a valuable and worthy predecessor.

It is quite impossible to give a summary of Dr. Taylor's very exhaustive study. He has given us a monograph of real and permanent value. He has made his writing interesting, in spite of the many details with which he deals, because he is keenly alive to every human response to the climatic and topographic environment. It would be well for all students of geography if there were many more such investigations, carried out by authors as competent as is Dr. Taylor and as thoroughly sympathetic with the broader aspects of the subjects with which they are dealing. R. DeC. Ward

Best, Elsdon. **The land of Tara and they who settled it: The story of the occupation of Te Whanga-nui-a-tara (the great harbour of Tara) or Port Nicholson, by the Maori.** Diagr. *Journ. Polynesian Soc.*, Vol. 26, 1917, No. 4, pp. 143-169; Vol. 27, 1918, No. 1, pp. 1-25; No. 2, pp. 49-71; No. 3, pp. 99-114; No. 4, pp. 165-177; Vol. 28, 1919, No. 1, pp. 1-17. New Plymouth, N. Z.

Cotton, C. A. **Mountains.** Ills. *New Zealand Journ. of Sci. and Technol.*, Vol. 1, 1918, No. 5, pp. 280-285. Wellington. [Brief summary of the author's work on the evolution of the mountains of New Zealand.]

Mayer, A. G. **Ecology of the Murray Island coral reef.** Maps, diagrs., ills. *Papers from the Dept. of Marine Biology of the Carnegie Inst.*, Vol. 9, 1918, pp. 3-48. Washington, D. C.

Ostenfeld, C. H. **Contributions to West Australian botany. Part II.** 66 pp.; map, diagr., ills. *Dansk Botanisk Arkiv*, Vol. 2, 1918, No. 8. Copenhagen. 4 kroner. 9½ x 6½. [Part I of this study, which contains some phytogeographic material, is noted in the *Review*, Vol. 2, 1916, p. 483.]

—— ***New South Wales, Geological map of.*** [1:1,137,760.] Prepared under the direction of E. F. Pittman, Government Geologist, Department of Mines. Inset: Australia, showing positions of Lord Howe and Norfolk Islands, 1 in. to 400 miles. Department of the Interior, Sydney, 1914.

—— ***New South Wales, Physical map of.*** [1:1,137,760.] Department of Lands, Sydney, 1915. [Hypsometric map with elementary hachuring (practically only for the divides) and three very general tints of brown for altitudes of 0-2,000, 2,000-3,000, and over 3,000 feet.]

—— ***New South Wales railways, Map of,*** showing coach and other routes from the various stations, together with mileage from Sydney, with diagrams of North Coast, South Coast, and parts of Southern and Western lines. 1 inch to 29 miles (1:1,837,440). Department of Lands, Sydney, 1918.

—— ***Trans-Australian Railway, Commonwealth Railways map shewing route of.*** [1:1,300,000.] Commonwealth Railways, [Melbourne,] 1918.

POLAR REGIONS

Arctic

—— **Baffin Bay and Davis Strait, Monthly meteorological charts of.** Published by authority of the Meteorological Committee. 1 page of text and 12 plates of maps. *Meteorological [Publ.] No. 221.* London, 1916.

The discussion during the past few years of the feasibility of the Hudson Bay steamship route has directed popular as well as scientific attention to the meteorological conditions of the whole northeastern portion of the North American continent and of its adjacent water areas and especially to the controls which the winds and the weather have over the amount of ice and its movement. The publication of the "Monthly Meteorological Charts of Baffin Bay and Davis Strait" was undertaken by the British Meteorological Office at the request of the Board of Trade and on the recommendation of the Conference on Ice Observation Vessels convened by that board in November, 1912. The data upon which the charts are based were obtained from logs kept especially for the Meteorological Office on board of exploring and whaling vessels. There are twelve charts, covering the six months May to October. For the remaining six months no data are available, or the data are insufficient. Six charts show the winds, pressure, air and water temperatures, and surface currents; the remainder give the available information with regard to the state of the ice in Davis Strait and Baffin Bay. In all about 39,000 sets of observations were used. Many facts of scientific as well as of practical interest are brought out and emphasized in the text. The winds most characteristic of the bay and strait are southeast and northwest, i. e. either up or down these bodies of water. Gales are associated with the passage of cyclonic depressions traveling, almost invariably, from west to east. The information regarding the currents may be considered particularly reliable. It is noteworthy that the Labrador Current, which is largely caused by the action of winds from the northward in the higher latitudes, is a good deal accelerated by the northerly winds which are frequent in these regions during most of the year. In contrast with the ice-congested area, which impedes or bars navigation in the bay and in the northern part of Davis Strait during three of the six months covered by the present charts, there are certain relatively ice-free sheets of water in summer and early fall in various parts of Baffin Bay or its tributaries. These are probably due to the upwelling of an undercurrent of oceanic origin from the south. Field ice is the most frequent form of ice in Baffin Bay and Smith Sound, while in Davis Strait the respective frequency of field, drift, and berg ice is about equal.

Regarding the charts themselves, it may be said that they present the available facts clearly and in great detail. Anyone who examines them, even in a cursory manner, cannot fail to be impressed by the large amount of meteorological and oceanographical information now available concerning these northern water areas, which are probably regarded by many persons as still practically unknown. The charted information in several cases extends as far as 80° N. From the practical point of view of the navigation of Hudson Strait it is, of course, disappointing that the words ''no information,'' or ''insufficient data,'' appear on several of the charts. For July and August, however, a fair amount of meteorological material is available right through to Hudson Bay.

It is, perhaps, not out of place to call attention to an important monograph, published ten years earlier than the charts reviewed above and dealing with the same area, by Dr. Ludwig Mecking, entitled ''Die Eistrift aus dem Bereich der Baffin-Bai beherrscht von Strom und Wetter'' (*Veröffentlichungen des Inst. für Meereskunde . . . Univ. Berlin,* No. 7, Jan., 1906). A comparison between the effects of currents and of wind on drift ice, based upon theoretical calculation, as well as upon empirical facts, is followed by a very detailed discussion of the ice drift in Baffin Bay as dependent upon currents and upon weather conditions, as evidenced by observation. The currents in Baffin Bay, as well as in the adjacent areas of Davis Strait, Hudson Bay, Melville Sound, etc., and extending as far as the Gulf of St. Lawrence on the south and the southeastern coast of Greenland on the east, are clearly shown on an excellent chart. Further, a series of small charts shows the isobars for the months of July and August preceding certain years whose ice conditions were selected for special study. A comparison between the prevalence of icebergs and of floe ice in each year and of the accompanying weather is made by means of a series of curves. The general weather conditions of the preceding summer were found to be the controlling factor in determining the amount of ice of glacial origin in the region under discussion, while the amount of floe ice is determined by the pressure gradient in the preceding November-January between southern Greenland and the mouth of the St. Lawrence River.

The first of the two publications here reviewed is essentially cartographic. The second is a very full discussion, with a minimum of maps. Together they give a large and important body of material on the ice of the Baffin Bay region. R. DEC. WARD

CHAFE, E. F. **The voyage of the *Karluk* and its tragic ending.** *Geogr. Journ.,* Vol. 51, 1918, No. 5, pp. 307-316.

EKBLAW, W. E. **The Danish Arctic station at Godhavn.** Map, ills. *Amer. Museum Journ.,* Vol. 18, 1918, No. 7, pp. 581-599.

—— **Eskimo, The origin of the.** Map. *Scottish Geogr. Mag.,* Vol. 33, 1917, No. 10, pp. 458-465. [Review of ''An Anthropological Study of the Origin of the Eskimo Culture'' by H. P. Steensby, Copenhagen, 1916.]

GALITZIN, B[ORIS]. **La délivrance de l'expédition Vilkickij dans les glaces polaires et le caractère synoptique de l'hiver et de l'été 1915.** *Bull. Acad. Imp. des Sci. [de Pétrograd],* Ser. 6, 1916, No. 4, pp. 213-218. [In Russian.]

Hoel, Adolf. **Nouvelles observations sur le district volcanique du Spitsberg du Nord.** 33 pp.; maps, diagrs., ills. *Kristiania Videnskapsselskapets Skrifter: I. Mat.-Naturv. Klasse,* 1914, No. 9. Christiania.

Hoel, Adolf. **Observations sur la vitesse d'écoulement et sur l'ablation du glacier Lilliehöök au Spitsberg 1907-1912.** 29 pp.; maps, ills. *Kristiania Videnskapsselskapets Skrifter: I. Mat.-Naturv. Klasse,* 1916, No. 4. Christiania.

Hovey, E. O. **Child-life among the Smith Sound Eskimos.** Ills. *Amer. Museum Journ.,* Vol. 18, 1918, No. 5, pp. 361-371.

MacMillan, D[onald] B. **Food supply of the Smith Sound Eskimos.** Ills. *Amer. Museum Journ.,* Vol. 18, 1918, No. 3, pp. 161-176.

MacMillan, Donald [B.] **Record-hunting in the Arctic.** Map, ills. *Harper's Mag.,* No. 820, Vol. 137, 1918, pp. 549-562.

—— **No man's land (Spitsbergen).** Reprinted from *The Spectator.* Ills. *Bull. Geogr. Soc. of Philadelphia,* Vol. 17, 1919, No. 1, pp. 23-27.

Speerschneider, C. I. H. **The state of the ice in the Arctic seas, 1918.** 22 pp.; maps. Special Print *Nautical Meteorol. Ann.,* 1918. Dansk Meteorol. Inst., Copenhagen, 1919. [A parallel account in Norwegian and English.]

Wissler, Clark. **Stefánsson returned after four years of Arctic exploration.** Map. *Amer. Museum Journ.,* Vol. 18, 1918, No. 7, pp. 600-601.

WORLD AS A WHOLE AND LARGER PARTS

Chamberlin, T. C. **World-organization after the world-war—an omninational confederation.** Map. *Journ. of Geol.,* Vol. 26, 1918, No. 8, pp. 701-727.

Cornish, Vaughan. **Geographical safeguards of the British Empire.** *United Empire,* Vol. 10, N. S., 1919, No. 3, pp. 109-119 (discussion, pp. 118-119). London.

De Magistris, L. F. **L'Italia nel Mediterraneo.** *La Geografia,* Vol. 6, 1918, No. 6, pp. 403-428. Novara.

Harris, J. H. **The league of nations and the tropics.** *The New Europe,* No. 129, Vol. 10, 1919, April 3, pp. 269-275. London. [The extension of mandatary administration over many of the less developed tropical territories is foreseen.]

Loon, H. W. van. **The golden book of the Dutch navigators.** xiii and 333 pp.; maps, ills. The Century Co., New York, 1916. $2.50. 9 x 6.

Miller, B. LeR. **Coal resources of the Americas.** Map, ills. *Bull. Pan Amer. Union,* Vol. 47, 1918, No. 4, pp. 511-533.

—— **Nickel deposits of the world.** With a preface by W. G. Miller and C. W. Knight. Maps, diagrs., ills., index. Reprinted from *Rept. of Royal Ontario Nickel Commission, 1917,* pp. 95-286. A. T. Wilgress, Toronto, 1917. [This reprint gives the chief geographic facts concerning the occurrence and production of a metal whose economic distribution is remarkably restricted. In 1913 the world production of nickel was approximately 30,000 tons, coming almost exclusively from two widely separate regions—Sudbury, Ontario, and New Caledonia. The circumstances under which the Canadian industry is conducted are well known; the New Caledonia industry is not so well known, and a geographical description of the island precedes the discussion of it. Before the commencement of Canadian competition in 1887 New Caledonia controlled the nickel market. In 1913 the production of the French island was only one-fifth that of her rival. The chief factors in the decline, absolute as well as relative, are the proportionately heavy cost of ore freight and still more the comparatively small size of the ore bodies.]

Vaughan, T. W. **Some shoal-water corals from Murray Island (Australia), Cocos-Keeling Islands, and Fanning Island.** Ills., bibliogr., index. *Papers from the Dept. of Marine Biology of the Carnegie Inst.,* Vol. 9, pp. 51-234. Washington, D. C., 1918.

Vaughan, T. W., J. A. Cushman, M. I. Goldman, M. A. Howe, and others. **Some shoal-water bottom samples from Murray Island, Australia, and comparisons of them with samples from Florida and the Bahamas.** Maps, diagrs., ills. *Papers from the Dept. of Marine Biology of the Carnegie Inst.,* Vol. 9, pp. 239-297. Washington, D. C., 1918.

THE
GEOGRAPHICAL REVIEW

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THE HANGING GARDENS OF THE MESA DE MAYA*

By CHARLES R. KEYES

Like an emerald solitaire, the hanging gardens of the Mesa de Maya are set in the tawny desert of our Southwestern tableland. A wonderful mass of verdure poised high above a boundless, waterless waste, this oasis is almost unique among the garden spots of earth, for it is mounted on a mile-high pedestal and is nearly 10,000 feet above sea level. Its even surface is richly fertile, intensely cultivated, and extraordinarily productive. Then, too, it is the home of a compact agricultural settlement which is as completely isolated from the rest of the world as if it were on an island in mid-ocean. Indeed, dwellers on the mesa look out upon the dreary monotonous sea of land about them as islanders do upon the ocean.

AN AGRICULTURAL EDEN

The existence of this community of thrifty and prosperous Northern farmers on the heights of a lonely rock in a Southwestern desert is really

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* As explained in the article, the author uses "Mesa de Maya" as a collective term to designate the group of mesas which extend eastward from the Rocky Mountain front at the Colorado-New Mexico boundary, although the term strictly applies only to the most prominent, an eastern, member of the group. Selecting from the somewhat divergent nomenclature in the literature and on the maps the names that seem most appropriate, we obtain the following, proceeding from west to east (cf. map, Fig. 1): the Rato Mesas, consisting of Raton Mesa, Bartlett Mesa, and Barilla Mesa; Johnson Mesa; Chicorica Mesa; nameless mesa east of Emery Gap; Long's Mesa; Mesa de Maya; Fowler Mesa; and Mt. Carrizo. The mesa-top farms with which the article deals occur on the Raton Mesas, particularly Barilla Mesa, and on Johnson Mesa.

The sources on which the map, Fig. 1, is based are of unequal value. Only a third of the area is covered by the topographic sheets of the U. S. Geological Survey, and these are of different dates and scales; for the remainder resort has to be had to the maps of the earlier government surveys and to state maps. For the greater part of the United States this situation is still typical of that which confronts him who tries to represent, on other than general scales, a given part of its surface. The maps used are the following: (a) topographic sheets, 1:125,000, Spanish Peaks (surveyed in 1895), Elmoro (1895), Mesa de Maya (1890), Mt. Carrizo (1890); 1:62,500, Brilliant (1912-13), Raton (1911-12), Koehler (1915); (b) others: U. S. Geographical Surveys West of the One Hundredth Meridian (Wheeler Survey), topographic atlas sheet No. 70 (A), 1874-76; General Land Office map of New Mexico, 1:760,320 (1896 edition, with relief in hachuring; on latest, 1912, edition relief is in characterless hill-shading); Clason's Industrial Maps of Colorado, 1:650,000 (Denver, 1913), and of New Mexico, 1:750,000 (1908), for roads; Southern Pacific Company railroad map of the United States west of the Mississippi, 1:760,320 (1910), for railroads.—EDIT. NOTE.

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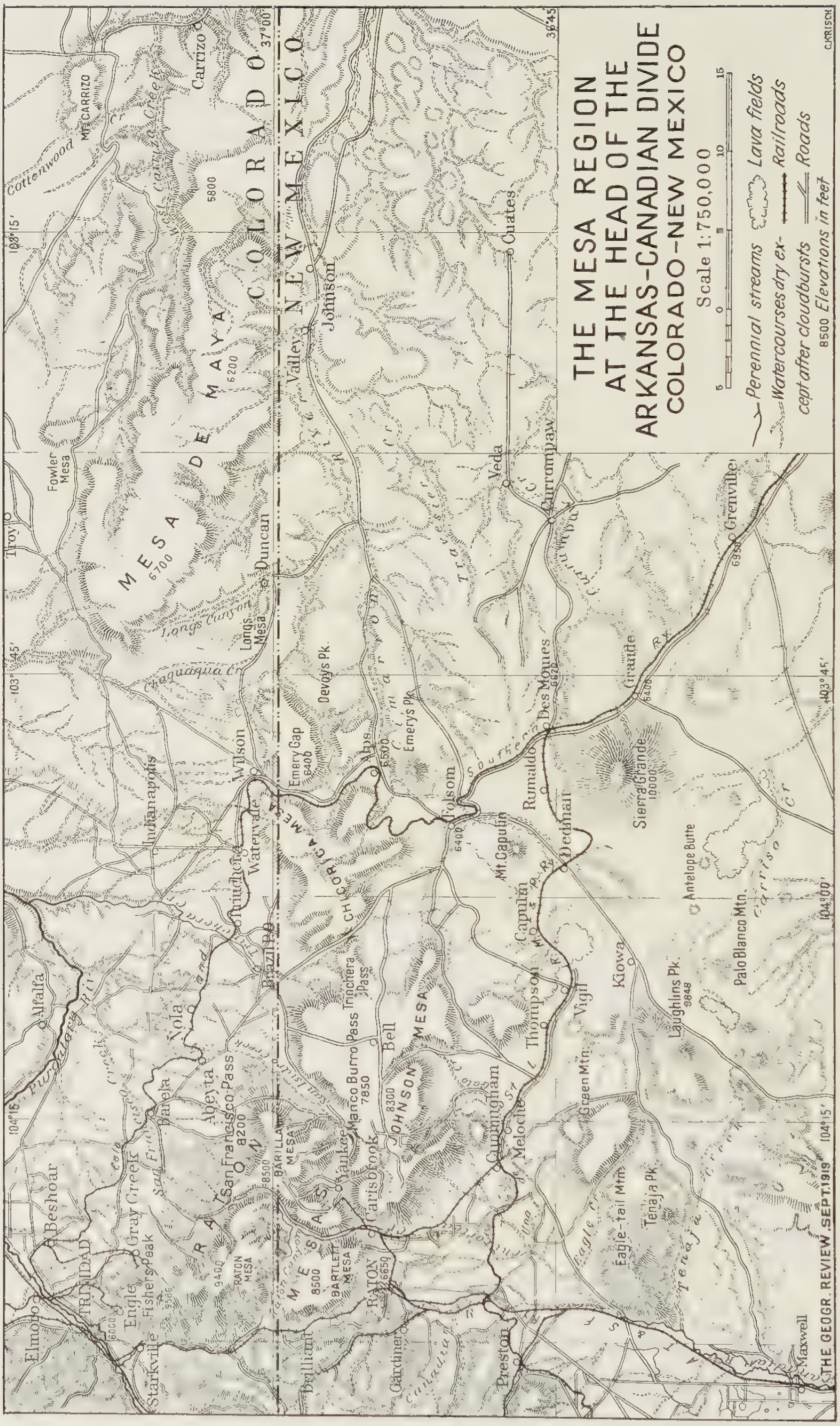

FIG. 1—(For sources see editorial footnote on preceding page.)

one of the agricultural marvels of our day and country. There, where a mile above the insufferable, barren waste is enjoyed the summer climate of the Upper Mississippi valley, are raised harvests of wheat and corn and oats more bountiful than in equal areas anywhere in the Northern States. Apple orchard and vineyard reproduce New England and New York. Vegetable patches surpass the truck lands of New Jersey and Maryland. It is the sole spot in all the vast Southwestern desert where irrigation is not resorted to in order to bring forth abundant crops. It is the westernmost extension of Eastern gardens into the arid country, a last lingering trace of a bygone time before aridity spread its withering touch over the land.

Application of the Term Mesa de Maya

It will be necessary to explain in some detail the application of the term Mesa de Maya. The name itself is of Spanish origin and signifies "armored tableland" (*malle*=mail, armor), a typically apt term for a natural stronghold. Specifically it is applied to a single mesa of southeastern Colorado, but the term well describes a whole series of mesas of like origin, and physiographers, with an eye to the genetic aspects of the landscape, extend the title so as to include the whole of the former vast highland plain of which the present elevations are merest remnants.[1] These remnants owe their preservation to a thick capping of basalt. At Fisher's Peak, the most westerly extension of the mesas, the basalt has a maximum thickness of 500 feet. Of more or less columnar structure, it forms a sheer-walled brow to the table mountain, which thence falls by a steep declivity of 3,000 feet to the surrounding plains. The old plain of which these mesas are all but vanquished vestiges is inclined slightly to the eastward. At the Rocky Mountain front it has an elevation of about 10,000 feet above mean tide. On the Texas line, 130 miles away, it declines to about 5,000 feet above sea level.

Origin of the Mesa de Maya

The Mesa de Maya plain appears to have been of vast expanse in Tertiary time and to have formed the general upland surface of this part of the American continent. Of the old Tertiary peneplanation level little or nothing remains outside of the mesa tops. The attainment of its present high position is regarded as having taken place in Late Tertiary times. Since desert conditions began to set in about the same time there is every reason to believe that the magnitude of the erosion is represented by the difference between this old peneplane level and the present plains level—an interval of 5,000 or 6,000 feet, or something over a mile of thickness. There are also many considerations supporting the assumption that this area

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[1] R. T. Hill: Physical Geography of the Texas Region, *U. S. Geol. Survey Topogr. Atlas of the United States*, Folio 3, 1900, p. 8.

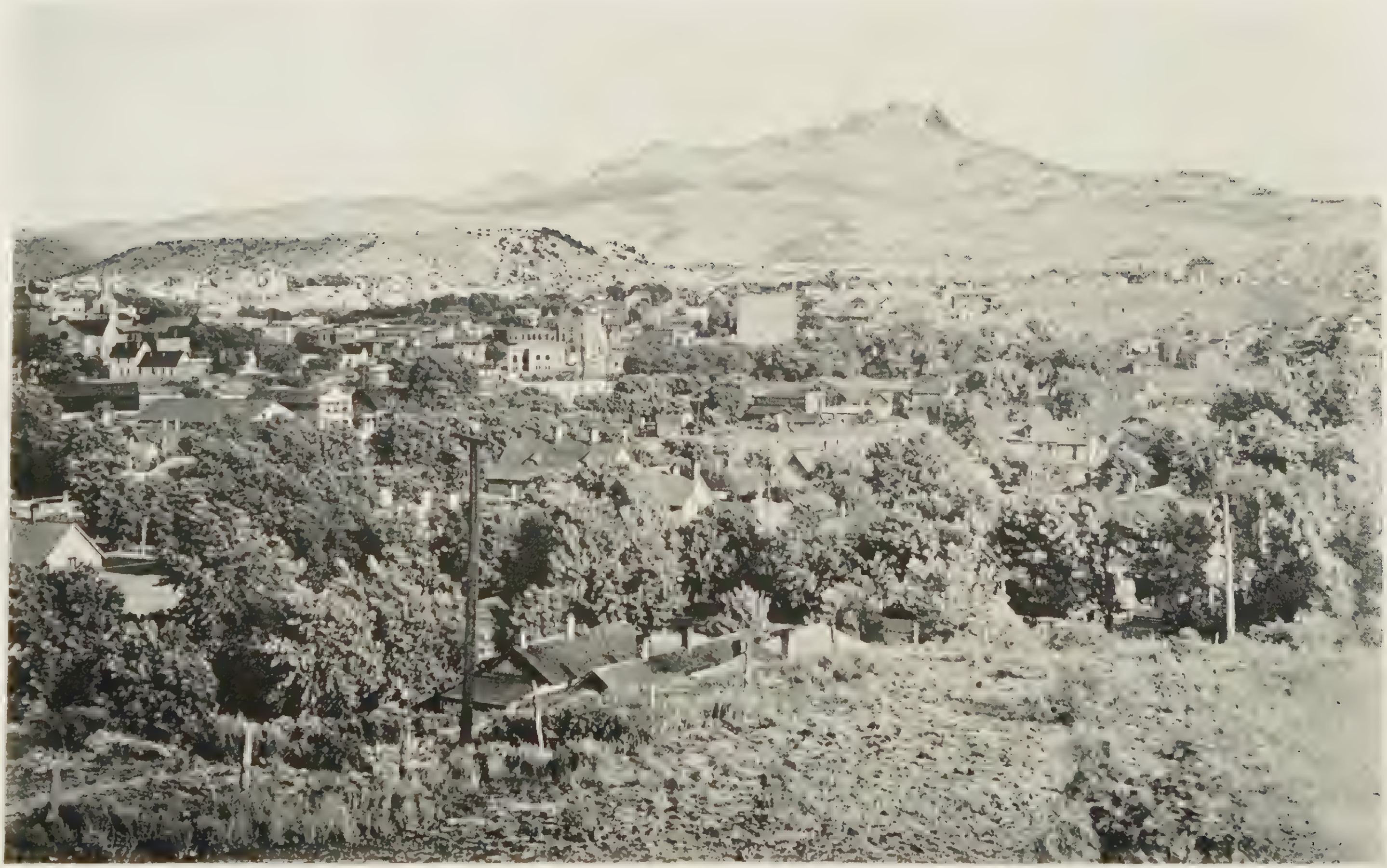

FIG. 2—Fisher's Peak, an outlying spur of Raton Mesa. Trinidad, Colo., in the foreground. (See also the view in *Geologic Atlas of the United States: Folio Elmoro* (*No. 58*), Fig. 2, U. S. Geol. Survey, 1899.)

before uplift was a vast plain and not a mountainous tract when the arid climate was inaugurated. The inappreciable aid of stream corrasion in this prodigious regional depletion is supported by the very prevalence of aridity itself. This region is one of the best extant demonstrations of the almost boundless potency of the wind in re-forming the face of the earth. The chief physiographic interest attached to the Mesa de Maya is, therefore, the novel manner of its depletion and the convincing evidence it affords of the tremendous potency and prodigious effects of eolian erosion. Nowhere else are the proofs of general land lowering through wind action better displayed.

The Wind-Eroded Landscapes

When once plainly discriminated, wind-graved landscapes are seldom mistaken for any other kind. Their individuality is very strong. Desert mountains rising abruptly out of the sea of earth around them impart the characteristic form of *inselberg* landscapes. The girdled mountains attest the vigor of natural sand-blast action and its maximum effectiveness at the plains level. Plateau plains of the desert manifestly represent former levels of the general plains surface. The notable absence of foothills, the frequency of rock floors, the smoothness of the wind-beveled surfaces are all unmistakable characteristics.[2]

The Mesa Gardens

In most arid lands the refreshing oasis is met with by descent into some hidden valley or gorge where the ground-water table reaches the surface. Thus invariably occur the oases of the Sahara. Of this nature, also, are the regions, famous in antiquity as the Gardens of the Hesperides, nestled under the beetling cliffs which form the border of the high, dry tableland of Cyrenaica. On the contrary, the gardens of the Mesa de Maya in their high-hanging situation are reached only after an arduous climb of a mile of elevation with a dozen miles of winding and twisting among bare rock.

Their elevation above sea level is not much less than 9,000 feet and they are therefore practically limited to the high mesas immediately south of Trinidad (see map). Fisher's Peak, an outlying spur of the Mesa de Maya, is, however, a point of faulty perspective. As viewed from Trinidad, ten miles away and 4,000 feet below, on the Atchison, Topeka and Santa Fé Railway, the flat summit is hardly apparent. To the gardens spread out over the top of the mesa the ascent is steep, a part of the wagon road near the end being blasted out of the living rock, where once was only the narrow trail of the mountain goat and of the fierce cougar.

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[2] See several papers by the author, including: Competency of Wind in Land Depletion, *Monthly Weather Rev.*, Vol. 45, 1917, pp. 57-58; Deflative Scheme of the Geographic Cycle in an Arid Climate, *Bull. Geol. Soc. of Amer.*, Vol. 23, 1912, pp. 537-562; Deflation and the Relative Efficiencies of Erosional Processes under Conditions of Aridity, *ibid.*, Vol. 21, 1910, pp. 565-598; Lineaments of the Desert, *Pop. Sci. Monthly* Vol. 74, 1909, pp. 19-30.

The cool green paradise of the summit flat which suddenly presents itself as one reaches the end of the ascent is a most pleasing and surprising contrast to the insufferably hot and desolate desert that is left below.

VULCANISM AND THE DESERT

The view over the desert from the Armored Table is extraordinary. To the more usual features of the desert are added the effects of vulcanism. Black basaltic rivers stretch out toward the horizon until lost in the distance. Huge volcanoes studding the plains surface look like molehills on a lawn. Majestic Mt. Capulin is a recent ash cone compared with which that of Vesuvius sinks into insignificance. It rises 3,000 feet above the base and its gigantic caldron is half a mile across. It is perhaps the most perfect volcanic cone in existence. Local tradition places its last eruption within the century. Certain it is that snow falling on its flanks melts instantly. It is the most recently active volcano in the United States, Lassen Peak in California excepted.

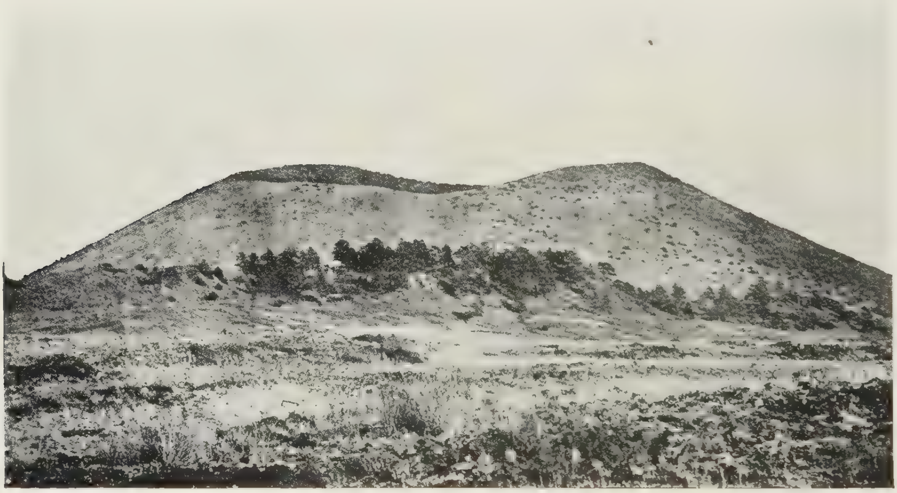

FIG. 3—Mt. Capulin, a recent ash cone in the volcanic district south of the mesa region. (Reproduced, by permission, from *Bull. Geol. Soc. of Amer.*, Pl. 81, Vol. 17, 1905.)

Interesting as the desert landscape may be to the physiographer it is inexpressibly dreary to most travelers. "The scant grass is low, colorless, mossy, and of a perishing look; shrubs and soapweed are stunted, and the bony cactus writhes like some grisly skeleton; the very stones seem burnt to cinder. One vainly looks for the flight of a bird such as cheered the eyes of Thalaba in the desert; no bee nor fly hums in the empty air; and save the horned toad, the genius of desolation, there is no living thing. The place is the very battle ground of the elements. In winter it is made fearful by raging storms of snow and wind; in summer by the scorching sun or suffocating dust storm."

The Oasis and Its Natural Wealth

But let the traveler turn his gaze across the mesa. Instantly he is transported in fancy to some Northern farm scene, with its manifold evidences of bounty, thrift, and contentment. The billowy wheat just turning amber for the plentiful harvest, the waving corn, the broad green meadows with some of last year's hayricks still unused, the close-cropped pastures crowded with fat, contented herds, the trim young orchards with boughs already groaning under their burden of luscious fruit, and the kitchen gardens full of varied and useful vegetables dispel all thought of such things as deserts. In the midst of all are cosy, substantial cottages and capacious barns such as are characteristic of rural prosperity in the great farming states. Even spring-house and dairy are not wanting.

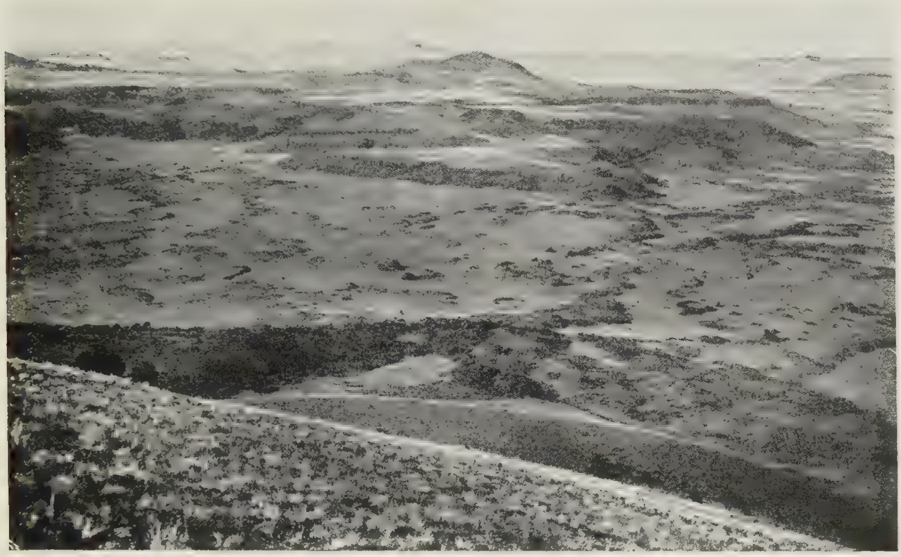

FIG. 4—View southwest from Mt. Capulin over the desolate volcanic district. (Reproduced, by permission, from *Bull. Geol. Soc. of Amer.*, Pl. 84, Vol. 17, 1905.)

Where in all the world is a land of plenty more compactly displayed than on this high-hanging oasis of an American desert? The summer sojourner in Colorado is well repaid for a brief visit to this unique freak of nature. The winter traveler to California profitably breaks a long journey by a day off at Trinidad for a drive out to the sky farms. To the geographer and the student of man and his environment a visit to the high-perched gardens of New Mexico is an unforgetable revelation. If the hanging gardens of Babylon were one of the seven wonders of the ancient world, surely the hanging gardens of the Mesa de Maya are among the seven natural wonders of the modern world.

An unlooked-for factor that makes the Mesa de Maya all the more inhabitable and capable of wide industrial expansion is the presence of an abundance of excellent fuel. In this almost treeless tract wood is scarce. Mineral fuel is plentiful. The entire mesa is underlain by thick seams of fine coal. Much of this coal is of the coking variety. Coke making is already a large industry at the foot of the mountains. Elmoro and Starkville coking ovens compare favorably with those of Connellsville, Pennsylvania. At present their output is used by the steel mills at Pueblo and by the smelteries generally throughout the Southwest and Mexico. One of the coal seams lies only a few feet beneath the lava cap of the mesa. Thus it chances that some of the highland farmers have coal mines in their back yards just as the thrifty New Englander has his woodpile.

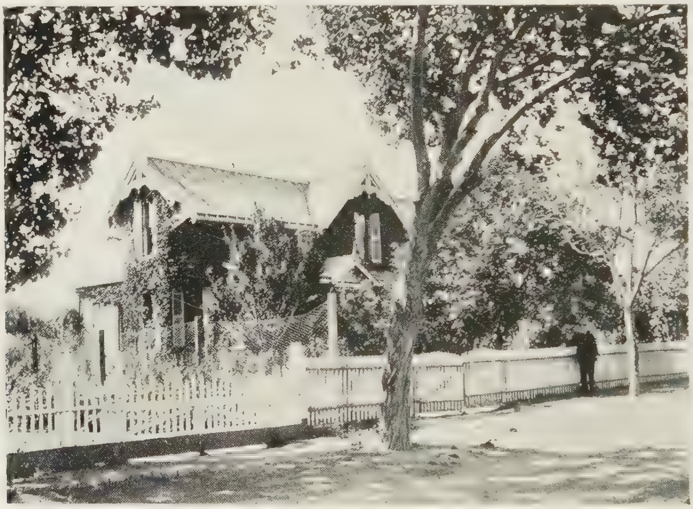

FIG. 5—A typical mesa-top farmhouse. The high elevation of the mesas, with their consequently greater rainfall, creates conditions akin to those of the Upper Mississippi valley or the Northern States in the midst of the Southwestern desert.

CLIMATIC EXPLANATION OF THE OASIS

After all, however, these high-hanging gardens of the Mesa de Maya are really not phenomena so anomalous as appears at first glance. They represent merely a specialized case of a widespread climatic feature of mountainous deserts. Throughout the mile-high desert range country with its torrid summer climate the two-mile-high mountain tops enjoy temperate conditions. Although the annual rainfall on the plains at the piedmont is only a few inches, on the summits it is frequently as much as 30 to 40 inches a year, about what it is in the Upper Mississippi valley.

The lofty Mesa de Maya differs from other desert ranges only in the circumstance that because of its peculiar geologic structure it possesses an extensive flat top enabling soil to accumulate and cultivation to take place, whereas other mountains are steep and bare and make farming precarious or impossible. Thus among geographic curiosities of the continent the great Armored Table stands without rival.

THE ANCIENT PIEDMONT ROUTE OF NORTHERN MESOPOTAMIA

By ELLEN CHURCHILL SEMPLE

The recurrent operation of geographic factors in history is nowhere more strikingly evinced than in the policies of commercial and territorial expansion directed toward the Mesopotamian Basin. Through the ages a long succession of Asiatic, European, and Egyptian powers have desired to control this natural transit land between East and West. Ancient Chaldean, Babylonian, and Assyrian kings pushed their frontiers from the Tigris west to the Mediterranean. Persian conquerors like Cyrus and Darius, incorporating in their expanding empires the coast land of the Levantine Sea, anticipated by two or three millenniums the present design of the British power in India to control this great diagonal land route from the Persian Gulf to the Mediterranean. History shows a like recurrent outreach from the West. Phoenicia, when Sidon was young, began the *Drang nach Osten* with the peaceful penetration of trade and the establishment of commercial colonies in Mesopotamia. The Pharaohs of the Eighteenth Dynasty, the Hittite power of Asia Minor, and the Greeks under Alexander the Great marched eastward as conquerors to the Euphrates bend and beyond. Rome's expansion over her military road through northern Mesopotamia anticipated the economic outreach of modern Germany over this strategic region. Nisibis was the easternmost outpost of the Roman Empire, and in 1918 it was the eastern terminus of the German-made Bagdad Railroad.

What are the geographic factors in this recurrent historical development, this drama which returns with monotonous action and theme, though the actors change in race, nationality, and civilization from one age to another?

SIGNIFICANCE OF THE MESOPOTAMIAN PASSWAY

The valley of the Tigris and Euphrates Rivers occupies a vast geographical trough extending diagonally across southwestern Asia from the Persian Gulf almost to the Mediterranean. It lies between the massive folded mountains of Persia and Armenia on the northeast and the plateau of the Syrian and Arabian Deserts on the southwest. Thus it forms a natural passway, flanked by two regions inhospitable to travel and transportation. It finds its eastern outlet through the Persian Gulf to the Indian Ocean, and its western outlet to the Mediterranean through a breach in the barriers of mountain and desert which form the eastern rim of the Levantine Sea. Except the Red Sea-Suez route, it has no effective competitor in the communication between East and West. The commercial significance of the Mesopotamian passway lies in the fact that it links now, as it did 5,000 years ago, two regions of contrasted climates, contrasted products, and contrasted civilizations—the temperate European countries of the Mediterranean Basin and the tropical Asiatic lands of the Indian and Pacific Oceans.

Difficulty of Access from the Levantine Sea

Access from the Mediterranean to the Mesopotamian passage is difficult, except at one point (Fig. 1). The eastern sub-basin of the Mediterranean, known as the Levantine Sea, is surrounded on its three sides by natural barriers. Its northern coast is hemmed in by the high and rugged Taurus Mountains, which maintain a mean elevation of 6,500 feet but rise at intervals in serrated walls 10,000 feet or more. They effectually cut off the sea from the plateau interior of Asia Minor, except for the meager traffic which picks its way over the high-laid passes.[1] The southern littoral of the Levantine Sea borders the vast expanse of the Sahara and Libyan Deserts. Across this barrier only the long-drawn oasis of the Nile opens an avenue southward. On the east the Levantine Sea faces a multiple barrier which rises behind an inhospitable coast, with scarcely a harbor worthy of the name. Overlooking this unpromising littoral is a line of mountains and plateaus, stretching from the Amanus Range in northern Syria to the towering massif of Sinai (8,530 feet) in the south. These highlands are nearly everywhere steep and lofty enough, as in the alpine heights of Lebanon, or repellent enough, as in the rugged limestone plateau of Judea, to constitute serious barriers. Immediately behind the coastal highlands runs a long, narrow trough which sinks in the Jordan valley and Dead Sea 682 to 1,293 feet below ocean level. From the brink of this rift valley a second system of mountains rises parallel to the first, maintaining a mean elevation of about 2,500 feet in the south but rising to imposing heights in Mt. Hermon (9,020 feet) and the long wall of the Anti-Lebanon. East of Palestine this inner range is formed by the abrupt scarp of the Arabian Plateau. Though it rises to only moderate heights, it is a serious barrier, because the deep canyons of its drainage streams obstruct rather than facilitate the ascent from the Jordan trough. Beyond this second mountain system stretch the Syrian and Arabian Deserts, quite to the banks of the Euphrates.

Communications Across the Barrier

The Levantine Sea is therefore cut off from its eastern hinterland by double mountain walls with a moat between. Passage across this country is a series of ups and downs. The railroad from Jaffa up to Jerusalem (2,600 feet, or 792 meters) stops on the summit, discouraged from further progress by the deep descent to the Dead Sea and the sharp ascent beyond to the heights of Moab. The railroad from Haifa follows a feasible route

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[1] D. G. Hogarth: The Nearer East, London, 1902, p. 36; Élisée Reclus: Géographie universelle, Paris, 1884, Vol. 9, pp. 470-479.

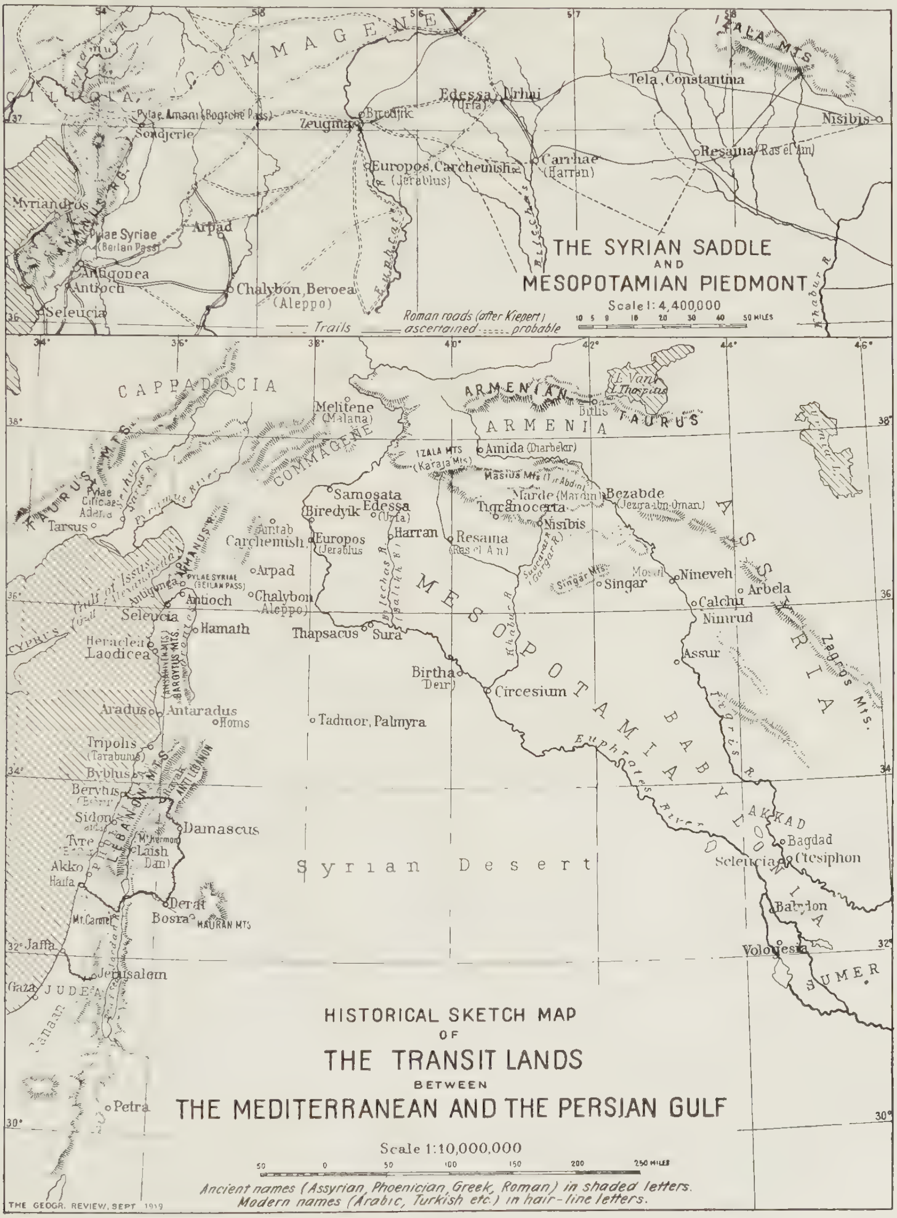

FIG. 1

eastward up the faulted plain of Esdraelon, along the track of an ancient highroad, to an elevation of 260 feet (80 meters), then drops down the canyon of the Jalud to the Jordan River, which it crosses at 815 feet (249 meters) below sea level, mounts the Yarmuk canyon to Derat at 1,886 feet (575 meters) and, turning northward to its natural goal at Damascus, ascends at Kisweh to 2,425 feet (739 meters) before reaching its destination in the great desert metropolis at an elevation of 2,266 feet (691 meters).[2] The Beirut-Damascus railroad mounts the steep slope of the Lebanon Mountains from the sea by twenty miles of rack-and-pinion track, crosses the summit of the range at 4,880 feet (1,500 meters), drops to the intermontane trough at Rayak at 3,500 feet (1,070 meters), crosses the Anti-Lebanon at an elevation of 4,610 feet (1,405 meters), and finally descends nearly 2,400 feet to the plain of Damascus.[3] After all the vicissitudes of up-and-down transportation, with its attendant heavy costs, these transverse railroads come out on the economic void of the Arabian Desert, save where the old volcanic soil of the Hauran and the oasis of Damascus offer limited areas of tillage.

The ancient tracks which once served travel and trade picked their way painfully across these upheaved barriers, finding their difficulties complicated on the leeward slopes of the mountains by the scarcity of water for man and beast. In the long dry summers the danger of thirst threatened also on the western or Mediterranean slopes, except where the great height of the Lebanon insured unfailing springs.

The Suez-Red Sea Route

The eastern barrier of the Levantine Sea has, however, a partial breach at each extremity, which in all times has readily admitted traffic from the Mediterranean. To the south the barrier shrinks and drops to the Suez Isthmus, which affords a short and level passage to the Red Sea. In ancient times the Suez-and-Red Sea route to the Orient carried comparatively little traffic, even in the palmy days of the Roman Empire. Violent northwest winds in the Gulf of Suez and the upper half of the Red Sea, prevailing all year down to the 20th parallel,[4] a broad belt of coral reefs along the shores, desert coasts, and for the most part desert hinterland—all combined to make navigation dangerous for sailing vessels and to reduce the profits of commercial voyages. To avoid the perilous course of the upper Red Sea, ancient traffic made a long detour up the Nile River to Thebes and thence eastward across the desert by caravan to some lower Red Sea port. This was the prevailing route also through the Middle Ages. The Suez-and-Red Sea route became feasible only after the introduction of steam navigation, which made ships independent of wind systems.[5] Hence the isthmian canal, which from very ancient times was projected, begun, and dropped—

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[2] Karl Baedeker: Palestine and Syria, Leipzig, 1912, pp. 140-145 and 240-242.

[3] *Ibid.*, pp. 295-298 and 300.

[4] Julius Hann: Handbuch der Klimatologie, Stuttgart, 1897, Vol. 3, pp. 76-77.

[5] M. Voss: Der Suez Kanal und seine Stellung im Weltverkehr, Vienna, 1904.

or constructed and then allowed to lapse into disuse again and again—first became profitable through steamer traffic.

The Syrian Saddle Route

A far more frequented route was that leading from the Levantine Sea through the northern breach in the barrier to the Tigris and Euphrates valley, and thence to the Persian Gulf. Where the Gulf of Alexandretta, the ancient Gulf of Issus, drives a marine wedge fifty miles back into the coast line of northern Syria, the mountain barrier contracts and drops to the single, relatively low chain of the Amanus Range, which forms a saddle connecting the tall and massive highlands to the north and south of it. This structural saddle, whose crest rises in general to 5,000 feet, was crossed in ancient times by three pass routes.

One led from the Cilician plain eastward up a tributary of the Pyramus River (modern Djihan) to the Pylae Amani, or modern Bogtche Pass, at about 3,000 feet, dropped thence down to the ancient Hittite town of Sendjerle near the modern settlement of Islahiya, whence it proceeded southeast over the plain to Chalyb or Beroea (Aleppo). This is the route of the modern Bagdad Railroad, which pierces the pass by a three-mile tunnel.

As originally projected, the railroad was to follow the second route over the Amanus Range, which was the established path of travel in the time of Alexander the Great. This route left the Gulf of Issus at Myriandros near the later Alexandretta, crossed the range by the Pylae Syriae, or Beilan Pass, at an altitude of 2,395 feet (730 meters), and descended thence to the plain of Aleppo at 1,215 feet on the east. This was Alexander's route after the battle of Issus in 332 B. C. and the most direct line of access to the Mediterranean for any modern railroad. The Macedonian army, approaching it from Cilicia along the narrow coastal road at the western foot of the Amanus Range, met the Persians drawn up to block their advance. The military German mind which built the railway saw in imagination this coast road bombarded by British ships and hence made the railroad take a long detour to the Bogtche Pass to the north.

Forty miles south of Alexandretta the Amanus Range is cleft by the gorge of the Orontes River, which cuts a passage to the sea. To the ancient Greek road builders this offered a feasible route of easy grade, only 21 miles long, from the Mediterranean up to the plain of Antioch and Aleppo. Early settlements, probably of Phoenician origin, at both entrances to the gorge, indicate that a rough track must have penetrated this passway in very ancient times. But it was the great pass city of Antioch and its port Seleucia which exploited their geographical position as the natural western termini of the great trade route to the East. Some day they may revive as railroad termini.

Behind the Amanus Range, where the Levantine mountain rampart is thus pierced and shrunken, the moat of the rift valley disappears; the inner mountain system runs out into low hills; and the last barrier formed by the Arabian and Syrian Deserts is superseded in this more rainy northern tract by a grassy plain, which with the Amanus Range fills the scant hundred-mile stretch between the Mediterranean and the great western bend of the Euphrates River. This plain receives from 10 to 20 inches of rain, enough to maintain ample herbage for the camels and horses of passing caravans and to support winter crops of wheat and barley. Furthermore, it is furrowed by small streams flowing down from the Taurus foothills to the north, whose waters have for ages irrigated the orchards and gardens of the big market towns scattered over this plain. Hence the ancients called it the Naharina, or "land of rivers."

This northern district of Syria therefore lets down nearly all the bars between the Mediterranean and the Euphrates. It may properly be called the Syrian Saddle, because here the multiple barrier of mountains and desert is reduced to a single low passage, which gives access to the great valley of the twin rivers, stretching away southeastward for 800 miles to the Persian Gulf.

The Euphrates as a Waterway

The Tigris-Euphrates trough varies in width from about 200 miles in the south to nearly 400 miles in the north, where the rivers emerge from the Taurus Mountains upon the plain. Except along its highland rim on the north and east, it has a rainfall so scant as to induce steppe or desert conditions over all its area. The alluvial tract of the lower valley was reclaimed to tillage and settlement only by irrigation. Northern Mesopotamia was a grassland in winter and early spring and a desert the rest of the year. The question now is: Where lay the main route of travel through this broad but arid trough?

At first glance the Euphrates River seems to afford the shortest and most obvious line of communication. And sure enough, we find that from the gray dawn of history (3000 B. C.) the river was utilized for the transport of cedar, cypress, and pine timber from the wooded slopes of the Amanus Range and the Lebanon,[6] and fine building stone and asphalt from upstream points, down to the head of the treeless delta and thence by canal over to the Tigris towns.[7] These bulky commodities were floated down the Euphrates on rafts buoyed up by inflated skins, like those depicted on ancient Babylonian and Assyrian monuments. The Euphrates, however, is a poor waterway and doubtless always has been. Gathering its main supply of water in its long mountain course in Armenia, it becomes navigable for rafts in the flood season from April to August. But when the short winter rains are over, when the spring floods due to the melting of the mountain snows subside, when summer heat and irrigation further deplete the volume of water, the Euphrates reaches so low a stage between August and late winter that navigation is constantly interrupted by shallows and reefs.[8]

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[6] Fritz Hommel: Geschichte von Babylonien und Assyrien, Berlin, 1885, pp. 325-330; Hugo Winckler: Geschichte Babyloniens und Assyriens, Leipzig, 1892, pp. 43-44 and 56.

[7] E. Speek: Handelsgeschichte des Alterthums, Leipzig, 1900, Vol. 1, p 289.

Ancient traffic on both the Tigris and Euphrates moved exclusively down stream.[9] The means of transportation were rafts and round wicker boats plastered with bitumen.[10] Such craft was unsuited to upstream navigation, especially in view of the swift current, which above the deltaic lowland runs four miles an hour in flood time. This was the season of navigation because the awkward boats were swept down stream to their destination by the rapid current and escaped the danger of shipwreck on the rocky reefs. Herodotus indicates that the Euphrates River was a common route for passenger traffic from the Mediterranean to Babylon.[11] In Pliny's time it took ten days to make the voyage down the river from a point near the mouth of the Balikh to Ctesiphon, the Parthian capital.[12]

The Euphrates has never invited the development of a busy highway along its banks. It flows through Mesopotamia but does not water it. Its swift stream lies at the bottom of a narrow, cliff-faced intervale, hardly accessible to the nomads on the plains above. Occasionally, where the cliffs recede and admit a broader strip of alluvium along the banks within reach of irrigation from *shadûf* and water wheel, villages with cultivated fields and date palms appear. The sparse sedentary population along the Euphrates, the meager products of the arid country, the scant local commissariat for caravan or army, and the constant danger of nomad attack or blackmail[13] combined to discourage ancient travel along the river above the delta, which marked the beginning of the dense population.

The Euphrates Valley as a Military Route

Among all the military campaigns conducted by would-be conquerors between Babylonia and the Syrian coast during 2,000 years or more, only one, so far as we have been able to discover, followed the route along the Euphrates. That was the expedition of Cyrus the Younger in 401 B. C., who took the shortest road to Babylon in order to surprise Artaxerxes before he had news of the revolt. The description of that journey in Xenophon's Anabasis shows this to have been no route for armies which had to live off the country. On the desert stretch below the mouth of the Khabur River, a thirteen days' march, many of the baggage animals perished from hunger, and some of the soldiers subsisted entirely upon the meat of the antelopes and wild asses grazing on the plains. At times it was necessary to prolong the day's march in order to get water and fodder. The few settlements on the river made a living by quarrying millstones which they sold to Babylon for grain.[14] A Roman campaign, which was planned in 242 A. D. to invade Parthia by the Euphrates route and capture Ctesiphon, proved abortive owing to the lack of food. The army reached Circesium at the mouth of the Khabur River but, failing to find there the store of provisions which it had expected for the long desert stretch of the march, mutinied and turned back.[15]

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[8] Meyers Konversations-Lexikon, article "Euphrat."

[9] J. L. Myres: The Dawn of History, London and New York, 1911, pp. 95-96.

[10] Herodotus, Bk. I, Ch. 194.

[11] *Ibid.*, Bk. I, Ch. 185.

[12] Pliny: Historia Naturalis, Bk. 5, Chs. 26 and 89.

[13] Strabo, Bk. 16, Ch. 1, § 27.

Caravan Routes

Caravans, carrying their own food supply, followed a variant of this route many miles east of the river. They must have been confined to winter and spring, when their camels could find forage. Possibly the caravan traffic of the cooler months was supplemented by river traffic during the hot summer, when navigation was good but desert travel particularly bad. In the time of Augustus, "the road of the merchants," as Strabo calls it, to Ctesiphon or Seleucia on the lower Tigris started from the Euphrates bridge at Europos (Hittite Carchemish and modern Jerablus) and led thence for twenty-five days southeast through the steppes and deserts of the nomad Scenitae, or tent dwellers, who gave the caravans safe passage for a moderate transit duty and furnished them with water drawn from local wells or brought from a distance.[16] The route along the river was avoided because of the exorbitant dues exacted by the tribes dwelling along the stream. At a later date (51 A. D.) a Parthian king evidently succeeding in suppressing or controlling this evil, because be attracted to his *entrepôt* of Vologesia and other towns on the lower Euphrates the trade which reached the upper river from Damascus. This Syrian metropolis maintained connection with the Euphrates by a desert trail running through a series of oases strung along the foot of a ridge to Tadmor,[17] and thence east to Birtha (modern Deir) near the mouth of the Khabur River, or north to Sura, located on the Euphrates between Thapsacus and the mouth of the Balikh. During the second and third centuries A. D. Palmyra, or Tadmor, as way station between the Euphrates and Middle Syria, enjoyed a short-lived prosperity which rose and declined with this caravan trade to the Persian Gulf.[18]

Desert Routes

Traffic on a small scale doubtless dribbled into Babylon and Damascus straight across the desert ever since those early days when "the Princes of

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[14] Xenophon: Anabasis, Bk. I, Chs. 4 and 5.

[15] Theodor Mommsen: The Provinces of the Roman Empire from Caesar to Diocletian, New York, 1887, Vol. 2, pp. 98-99.

[16] Strabo, Bk. 16, Ch. 1, § 27.

[17] D. G. Hogarth: The Nearer East, p. 135; Ellsworth Huntington: Palestine and Its Transformation Boston, 1911, pp. 337-340.

[18] Mommsen, *op. cit.*, Vol. 2, pp. 50, 69, 101-102, and 106.

Kedar'' brought in lambs and rams from their meager pastures for the markets of ancient Tyre. The nomads were the natural middlemen and carriers in this desultory trade. In their normal course of life, they drifted down to the marsh meadows of the lower Euphrates in summer, when their water holes were dried up and their pastures burnt bare, then back again to the desert when the winter rains revived the herbage, and on to towns of the desert fringe like Damascus and Bosra,[19] to barter the products of their herds and their slender stock of Babylonian merchandise for grain and arms—the wheat of Bosra and the steel of Damascus. The Babylon and Damascus trail doubtless followed the modern caravan route. The desert junction of Petra, which traded with Gaza and Egypt, imported nothing from Babylonia, so far as the evidence shows, but only the rare products of Arabian Yemen together with the Indian and African commodities brought to Aden (Adane) and Mocha (Muza). These goods were carried from the southern ports up the Red Sea to Leuce Come (about latitude 24° N., near the modern Janbo) on the Arabian coast during autumn and winter, when the southeast monsoon was blowing. There they were transferred to caravans for transportation to Petra. The route probably followed approximately the line of the Hejas Railroad from Medina to Maan. It was impracticable for an army, so the Nabataean guide maintained who advised that the Roman campaign against this country in 25 B. C. should move by sea. The guide was made the scapegoat of an unsuccessful expedition and charged with treachery by Strabo,[20] who with biased judgment reasoned that the route was feasible for large caravans and therefore for an army of over 10,000 men. Only this trade in aromatics, goods of small bulk and large value like frankincense, myrrh, cinnamon, and perfumes,[21] could stand the heavy cost of desert transportation. Fodder and water had to be purchased all along the way, and transit dues had to be paid in addition to the imperial Roman customs. Guards had to be employed then as now to protect the caravan against the robber nomads. Pliny reckoned the total cost of carriage for a camel's load of frankincense from Leuce Come to Gaza at 688 denarii, or $150.[22] Only the wealth and luxury of the Roman Empire could have supported this caravan trade on a large scale; and even so it must be remembered that the major part of these Oriental luxury articles reached Mediterranean ports by the Red Sea-and-Nile route to Pelusium or later to Alexandria.[23]

The Route of Ancient Military Commanders

Diligent research discloses no evidence that desert routes ever forwarded a large amount of trade or were ever traversed by an army. The nearest approach to such a venture was that of the Babylonian prince Nebuchadnezzar in 605 B. C. He was in southern Palestine about to pursue the forces of Pharaoh Necho into Egypt, when he learned that his father, Nabopolassar, had died. Fearing a pretender might arise, to save time he hurried across the Arabian Desert to Babylon with a small band of followers; but he sent his army by the circuitous route around by the Naharina, the western bend of the Euphrates, and northern Mesopotamia by which he had come.[24] Countless conquerors before him had traveled this road, whether they marched east or west.

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[19] Mommsen, *op. cit.*, Vol. 2, pp. 169-170.

[20] *Ibid.*, pp. 316-317, footnote 2.

[21] Strabo, Bk. 16, Ch. 4, §§ 19, 23, and 24.

[22] Pliny: Historia Naturalis, Bk. 12, Chs. 14 and 65.

[23] Strabo, Bk. 16, Ch. 1, § 24.

This was the route of Alexander the Great. Moving north after his conquest of Egypt and Phoenicia, he crossed the Euphrates at Thapsacus in August 331 B. C. for the invasion of Mesopotamia. He did not take the short way down the river to Babylon, but struck north up the Balikh valley and then east along the piedmont of the Taurus foothills to the Tigris River, because this route offered the easiest line of march, provisions for his men, and fodder for his animals; so Arrian, his chronicler, tells us.[25] In Mesopotamia a food supply big enough for a large army and its transport in late summer pointed to irrigated fields, a sedentary population, and considerable towns. These were conditions which attracted ancient armies and traders to this route. They attracted also the German promoters and engineers who projected the modern Bagdad Railroad.

Antiquity of This Route

As far back as we can penetrate into the remote past, we find that the main line of communication from the Persian Gulf to the Mediterranean followed a land road east of the Tigris along the base of the Persian highlands north to Assur or Nineveh near modern Mosul, ran thence westward along the piedmont of northern Mesopotamia to the great western bend of the Euphrates, which it crossed by ford or ferry according to the place and time of the year. Thence it continued west past Chalybon (Aleppo) to the Mediterranean by the Amanus passes or by more devious and difficult tracks farther south. From Aleppo eastward to Mosul this is the route of the Bagdad Railroad, which between Mosul and Bagdad follows the level west bank of the Tigris to avoid engineering difficulties and reduce operating expenses. Many of the stations on or near the railroad, like Nisibis, Ras-el-Ain (Resaina), Harran, Jerablus (Carchemish), and Aleppo meet us at the beginning of history. They have seen the encampment of royal Babylonian armies 2000 or 3000 B. C., and they have watched the sheik Abraham pitch his tents by their wayside waters, as he drifted westward with his clan towards the land of Canaan.[26]

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[24] G. C. C. Maspero: The Passing of the Empires, New York, 1900, p. 518; George Rawlinson: The Five Great Monarchies of the Ancient Eastern World, New York, 1870, Vol. 3, p. 49, footnote 16.

[25] Arrian: Anabasis of Alexander, Bk. 3, Ch. 7.

[26] Genesis, xi, 31: xii, 4-5.

Climatic and Geographic Reasons for This Route

This ancient route between the Syrian Saddle and the Tigris highway finds its explanation in the climatic and geographic conditions of northern Mesopotamia. These have determined the distribution of settlements and the main lines of travel in this semi-arid land. Mesopotamia is a region of meager winter rains and long summer droughts. The dry season falls in the hottest part of the year, when great heat prevails over the plains and evaporation is intense. The precipitation from May to November is practically nil, and even in the cold season it is scant. The plains from the Persian Gulf north to the 36th parallel get less than 8 inches, or 200 millimeters, of rain[27] (Fig. 2). From this line northward precipitation increases owing both to the more northern location and the higher elevation of upper Mesopotamia. The increments, however, are very small. The line of ten inches (250 millimeters) annual rainfall describes an arc subtended by the 36th parallel, with one extremity 30 miles southeast of Mosul and the other at Aleppo, while the curve runs up the Tigris River and along the crest of a series of highlands which form an outlier of the Taurus system and wall in the plains of Mesopotamia on the north.

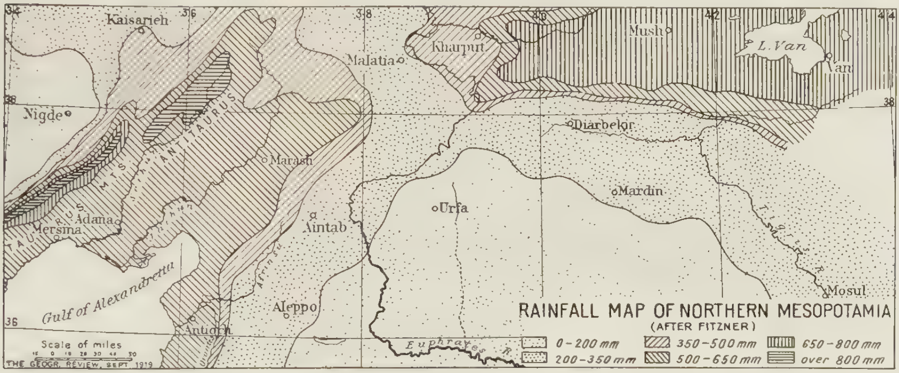

Fig. 2—(Based on source cited in footnote 27).

The Urban Belt

These highlands consist of the Tur Abdin (ancient Mt. Masius), a long narrow plateau of 3,300 to 4,000 feet elevation with a steep escarpment to the south, and the Karaja Mountains (ancient Mt. Izala), an old volcanic massif which maintains a general altitude of about 4,100 feet, but rises to 6,068 feet in its culminating peak, only to sink westward towards the Euphrates bend in an undulating upland 2,600 feet above sea level.[28] These massive foothills of the Taurus are high enough to wring some moisture from the reluctant clouds. In winter they accumulate snow enough on their upper slopes to form a considerable reservoir of moisture; and in the spring they drop a fringe of slender torrents down to the plain. Their irrigating streams through the ages have reclaimed the northern border of the Mesopotamian steppe from pastoral nomadism and stretched a piedmont belt of towns, surrounded by well-watered gardens, orchards, vineyards, and fields, to link the settlements on the Tigris with the western bend of the Euphrates and the Syrian Saddle.

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[27] Rudolf Fitzner: Niederschläge in Klein-Asien, *Petermanns Mitt. Ergänzungsheft No. 140*, 1896, p. 90, rainfall chart.

[28] Hogarth, *op. cit.*, pp. 62, 91, and 97.

The breadth of this urban belt, the density and prosperity of its population, has generally depended upon the strength and sanity of the ruling governments, whether in Babylon, Nineveh, Antioch, Rome, or Bagdad. Its northern edge in ancient times, as in modern, was pushed well up into the highlands to an altitude of about 2,000 feet at Urhai or Edessa (modern Urfa), at the ancient Babylonian Tela near the later Roman Constantina and modern Veranshehr, as later in the first century B. C. at the Armenian capital of Tigranocerta, whose mound of ruins lies beside the modern Koihissar; and at Marde (modern Mardin) it climbed the steep slope of Mt. Masius to 3,050 feet. These upper towns enjoyed comparative immunity from nomad raids from the steppes, while they commanded numerous springs and an assured water supply. However, in Mardin in the twelfth century every house had its cistern for storing rain water;[29] ancient cisterns everywhere indicate the economy practiced.

The downstream settlements of this urban belt, like Harran or Carrhae, Resaina or Ras-el-Ain, and Nisibis, lay only about 1,400 or 1,500 feet above sea level; though more precariously located as to water supply and nomad attack, they nevertheless occupied a better position for trade. They were stations on the great piedmont route between the Tigris and the Euphrates, which was a type of all such roads in semi-arid lands. It marked the nice adjustment between the farthest encroachment of the desert uphill in the dry season, and the farthest assured reach desertward of the irrigation streams from the mountains behind. North of this line, where the slope from the marginal highlands was steeper, the deeper valleys cut by the swift drainage streams and the more rugged character of the country presented obstacles to transportation.

Seasonal Deviations from the Established Route

It must not be supposed, however, that the ancient route never deviated from this line; that would be contrary to the nature of primitive roads in grasslands. In the late summer, when the interfluvial spaces were parched and the water holes dry, especially when a succession of almost rainless years had expanded the domain of the desert, then army or caravan would take a parallel path farther north, near the upper edge of the urban piedmont belt. It would cross the Euphrates at Biredjik, one of the most important crossing places of the river from time immemorial, site of the Greek Zeugma or bridge,[30] and turn thence east to the ancient Greek Edessa and yet more ancient Aramaic Urhai. Then, passing numerous villages, now heaps of ruins except for their ancient cisterns which still serve travelers till late summer, it would go eastward through the upper hill towns till it reached ancient Marde. This upper track, maintaining a general level of 2,000 feet, was nearer the springs that fed the streams and offered better pasturage for the pack animal. From Marde, however, it dropped down to Nisibis, which lay on the Gargar, the last perennial stream. Few of these piedmont rivers outlive the summer drought and the tax of irrigation. The Gargar, which still waters the gardens and fields of Nisibis, is sometimes 20 feet wide in August and too deep to be crossed except at fords.[31] Nisibis was therefore always a station on the piedmont route.

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[29] Guy Le Strange: The Lands of the Eastern Caliphate, Cambridge, 1905, p. 97.

In the dry season the track continued eastward, hugging the foot of the Tur Abdin escarpment with its fountains and wells all the way to the Tigris gorge at ancient Bezabde (modern Jezira-ibn-Oman). This was the road taken by Alexander the Great in the summer of 331 B. C. An eclipse of the sun fixes the date when he crossed the Tigris as September 20, the climax of the dry season.[32] However, after the winter rains had carpeted all northern Mesopotamia with grasses and flowers, the main route turned southeastward, about 20 miles east of Nisibis, and struck out straight towards Nineveh across an arid stretch of 30 miles, until it met the wadis draining northeastward from the Singar Mountains to the Tigris. This is the path of the Bagdad Railroad from Nisibis to Mosul. So stable is the geography of communications in these semi-arid lands. Yet another variant, feasible in spring for armies, turned west from Nineveh and followed the southern base of the Singar Mountains, whose barrier was high enough to make the passing winds pay a toll of water; then bent north through a gap in the range to Nisibis,[33] crossing the sheaf of wadis which united to form the Saocaras River (modern Gargar). This route was less favorable for caravans than for armies because it was exposed to nomad raids.

HISTORICAL EMERGENCE OF THE PIEDMONT ROUTE

Historical evidence shows that the Mesopotamian piedmont was the chief link between ancient Babylonia and the West. This is indicated by the persistent trend of Babylonian and Assyrian expansion westward along this piedmont, especially after 1500 B. C., when we begin to get reliable accounts of the wars for the control of northern Mesopotamia. The need of lumber in the treeless lands of the delta was the original motive which induced the early kings like Sargon of Akkad (2500 B. C.) to conquer the well-wooded mountains of the northwest and to extend their dominion over "the lands of the sunset sea,"[34] as the cuneiform records call the Mediterranean. The Euphrates River may have been the original outward line of exploration, as it undoubtedly brought down to Babylon the bulky exports from the Amanus and Lebanon forests;[35] but the piedmont route early begins to emerge in the movement of armies, the spread of commerce and religions. The names of its cities appear in early Babylonian history—Assur, Singar, Nisibis, Tilli or Tela, and Harran.[36]

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[30] Strabo, Bk. 16, Ch. 1, § 23.

[31] Max von Oppenheim: Vom Mittelmeer zum Persischen Golf, Berlin, 1900, Vol. 2, pp. 26, 31, and 256.

[32] Arrian, *op. cit.*, Bk. 3, Ch. 7.

[33] G. C. C. Maspero: The Struggle of the Nations, New York, 1897, p. 643.

Harran and Its Importance

Harran or "Road Town", located on the Bilechas River (Balikh) on the trunk route of northern Mesopotamia and at the focus of tracks radiating fanwise to the several fords of the Euphrates elbow, was the most important and influential city of all this region.[37] Of independent origin, reputed by tradition to be the first town after the Flood,[38] it became the western outpost of Babylonian civilization. By the tenth century B. C. it was a capital of Assyria co-equal with Assur itself. It was the seat of the ancient moon cult, which spread thence to Babylonia at a very early date and which later colored the religious life of Assyria to the east and of Phoenicia, Syria, and Palestine to the west.[39] Many of the foreign cultural influences apparent in Syria and Palestine emanated from Harran rather than from Assyria, to which they have been attributed. Contrarywise, many Occidental influences which can be discerned in the cults of Babylonia spread to the lower Tigris by way of Harran. The Syrian weather god Rammon is domiciled in Babylon by 2000 B. C., and he is worshipped in Assur on a par with the local god Assur in 1800 B. C. The goddess Ishtar, or Astarte, or Astaroth, was chief deity of Nineveh and Arbela in Assyria. Her worship spread thence westward along the piedmont to Phoenicia, Cyprus, and western Asia Minor along the routes of Phoenician traffic in the second millennium B. C.[40]

Phoenicia early secured her trade connections with the piedmont belt, because this opened up her most productive hinterland.[41] She did this by means of inland colonies or trading stations, located at strategic points along established routes. Laish, or Dan, a Sidonian colony of the fifteenth century B. C., situated at the sources of the Jordan River, gave access to the old military road which led north through the Lebanon trough[42] to the Euphrates bend. Hamath, of supposed Phoenician origin, was a station on the Orontes road, and Thapsacus, at the Euphrates ford, commanded the trading advantages at the crossing of the river. Nisibis, claimed as a Phoenician foundation because of its name,[43] was probably rather the seat of a Phoenician commercial factory which introduced there the wares and religions of the West. Harran participated actively in the markets of Tyre in Ezekiel's time[44] and doubtless much earlier when it was an important independent city and middleman between West and East. All Syria and Palestine evidently regarded the piedmont route as their chief line of communication with Babylonia and Chaldaea. According to Jewish legendary history, it was from Harran on this old trunk road that Abraham and his nomad tribe moved westward to Canaan.[45]

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[34] Eduard Meyer: Geschichte des Alterthums, Berlin, 1913, Vol. 1, pp. 420 and 519-520.

[35] Hommel, *op. cit.*, pp. 328-330.

[36] Maspero: The Struggle of the Nations, p. 26.

[37] R. W. Rogers: A History of Babylonia and Assyria, New York, 1900, Vol. 1, p. 300.

[38] Le Strange, *op. cit.*, p. 103.

[39] Eduard Meyer, *op. cit.*, Vol. 1, pp. 420, 519-520, and 606; Winckler, *op cit.*, pp. 148-149.

[40] *Ibid.*, pp. 163-171.

[41] Wilhelm Götz: Die Verkehrswege im Dienste des Welthandels, Stuttgart, 1888, pp. 95-97; Maspero: The Struggle of the Nations, pp. 193-194.

Commercial Value of the Mesopotamian Piedmont

The Mesopotamian piedmont of town and highway extended west to the great bend of the Euphrates. There it joined the populous plain of Naharina and the Syrian Saddle, which together were the focus of trade routes radiating north, west, and south. One well-traveled road led up from Egypt along the narrow land bridge between the Mediterranean waste of water and the Arabian waste of desert sands. Another ran northwest across the Cilician plain and over the Pylae Ciliciae, or Cilician Gates, in the mighty Taurus range to the Hittite country on the Halys River in Asia Minor, where it connected with tracks leading west to the Aegean Sea. Yet another ran north from Harran through Urfa and Samosata at the passage of the Euphrates to Melitene (Malatia), where it connected with the main road through Asia Minor to the Hittite country. Besides these land routes, dissolving Mediterranean trails, whose signposts were the stars, brought Phoenician cargo ships from Egypt, Crete, and other Aegean lands and contributed rare oversea products to this focal market region.

The commodities meeting here for exchange were varied—pearls, jewels, and spices from India; embroidered garments and imitation lapis lazuli from Babylonia; gums, perfumes, drugs, and frankincense from Arabia; linen, goldwork, and inlaid ivory from Egypt; horses, cattle, and metals from Armenia and the northern mountains; sheep, goats, fruits, and wine from the piedmont towns of Mesopotamia; olive oil, wines, copper, and Tyrian purple from the Mediterranean lands, besides the beautiful manufactured wares of the Phoenician cities.

All these routes with their richly laden caravans converged upon the cities strung along the western bend of the Euphrates from Thapsacus to

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[42] Judges, xviii, 7 and 28; F. C. Mövers: Die Phoenizier, Berlin, 1850, Vol. 2, pp. 136 and 160.

[43] Mövers, *op. cit.*, pp. 161-165.

[44] Ezekiel, xxvii, 23.

[45] Genesis, xi, 31; xii, 5.

Samosata and those scattered over the plain between the river and the foot of the Amanus Range. Each city became a market because it was a necessary stopping place. It commanded a ford or ferry across the Euphrates, which involved a halt until all the long caravan should have safely crossed; or it supplied water to the merchant and his transport from the stream which irrigated its gardens and orchards. This was a desirable district. It offered big profits to the trader and big revenues to the government. Its towns were inhabited by merchant princes of vast wealth. Azaz, Arpad, Pethor, Chalybon (Aleppo), and Carchemish yielded rich booty or ransoms to the conqueror.[46] Hence this whole region early became the object of conquest from every side, while the Mesopotamian piedmont belt, which linked it with the tropical East, was hardly less the goal of expansion. Every contiguous power, no matter how small or unorganized, tried to set up its toll-gate on this great highway. A map of the series of conquests in this region from 1600 B. C. to the Crusades (see Fig. 3 for the period 1500-720 B. C.), and again through the modern period, shows all the great historical episodes to have been cast in the same mold; and this mold in turn was

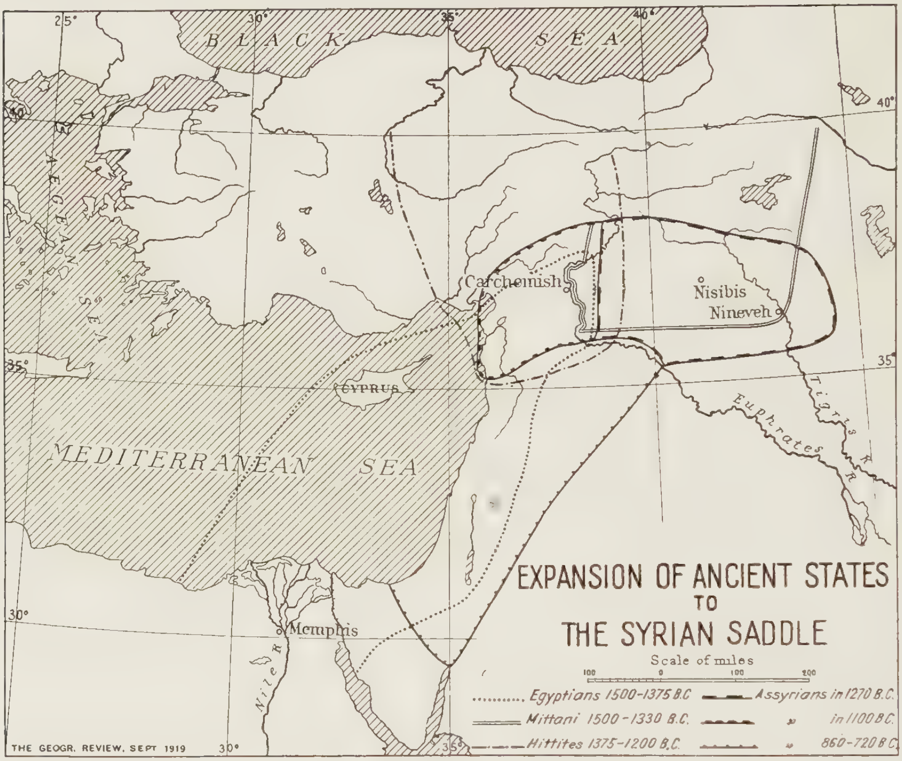

FIG. 3

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[46] Rogers, *op. cit.*, Vol. 2, pp. 64-65 and 75, footnote 2; A. H. Sayce: The Hittites, London, 1890, pp. 46-47.

fashioned by the geographic conditions. The artificers were in turn of all races, tongues, religions, and cultural development; but their hands knew only the one cunning when it came to turning out historical events in this region.

BABYLONIAN STRUGGLE FOR TRADE CONTROL

Babylon, as we have seen, claimed suzerainty over the Syrian Saddle and the piedmont belt from about 3000 B. C. From the time when Sargon of Akkad made his expedition against the Amorites of the Orontes valley in 2500 B. C., Babylonian influences were strong throughout northern Syria,[47] disseminated there by caravans traveling either by the Euphrates track from Babylon or by the piedmont route, which apparently got most of the traffic. The Babylonian king Kadashman-Kharbe (c. 1450 B. C.), finding himself excluded from the piedmont road by Assyria's occupation of northern Mesopotamia, undertook to open a road across the Syrian Desert. He subdued the nomad Suti dwelling about the mouth of the Khabur River, made wells, erected military posts, and established Babylonian settlements along the way, which probably ran through Tadmor to Damascus. By this route, which was shorter and avoided the long detour to the north, he hoped to divert the western trade from Assyria, which was expanding along the piedmont to secure this very trade.[48] The desert road was apparently a failure, for very soon Babylonia is again fighting Assyria for the control of northern Mesopotamia, and keeps up the conflict for centuries.[49]

THE RELATION OF NINEVEH TO THE PIEDMONT ROUTE

Assyria, owing to her geographic location, had a dominant interest in the traffic which moved along the piedmont belt to and from the Mediterranean ports. The cities of Assur and Nineveh, situated on the upper course of the Tigris at the head of regular navigation, were the eastern termini of the piedmont route. There goods were transferred from caravan to *kelek* for transportation downstream to Babylonia; or they went north to the fertile Lake Van district (Lake Thospitis) of Armenia by a road up the Tigris valley and over the Taurus Mountains by the Bitlis Pass (5,000 feet), the route followed later by Xenophon's retreating army. Yet other wares went east through Arbela and over the passes in the Zagros Mountains to Media.[50] Thus Nineveh, like Carchemish on the Euphrates, was a river town at the focus of land routes. Geographical location made it the natural middleman between East and West, stimulated commercial and territorial expansion, and impelled it especially to secure control of the piedmont route to the west. Hence Nineveh drove out all competitors and monopolized the profits. Finally, she seized the fords of the Euphrates at the great bend and controlled the highroads to the Phoenician ports. The process of western conquest went on for seven centuries with alternating success and failure; but it was not relinquished until Nineveh fell to Median attacks in 607 B. C.

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[47] Eduard Meyer, *op. cit.*, pp. 389 and 601-604.

[48] Hugo Winckler: History of Babylonia and Assyria, transl. and edit. by J. A. Craig, New York, 1907, pp. 82-83.

[49] *Ibid.*, pp. 84-85 and 93-94.

[50] Winckler: Geschichte Babyloniens und Assyriens, pp. 147-148.

THE DEVELOPMENT OF ASSYRIA

"The land of the city of Assur," the original Assyria, was a colony or vassal state of Babylon;[51] but it developed differently from the motherland, owing to geographic conditions. It was poor in irrigable plowland, and for this reason also turned to commerce. Its more northern location, its relatively cold winters and prevailing mountainous relief tended to produce a more enterprising and energetic population than was to be found on the low alluvium of Babylonia. Moreover, the people were probably a pure Semitic stock, unmixed with the Sumerian blood which diluted the Semitic strain in the deltaic lowland. Hence Assur developed a different type of people with different interests.[52] It became a typical colonial frontier state, with a natural tendency to political defection born of remoteness, contrasted conditions, and divergent interests.[53] So it set up an independent government some time between 1800 and 1500 B. C. When the kingdom of Assyria expanded, it spread northward and westward along the lines of least physical resistance and greatest commercial opportunity. It never for any length of time transcended the Zagros Mountains to the east or the main Taurus range to the north. Its military campaigns in these directions seem to have been primarily defensive or punitive, designed to protect its own borders, while those towards the west reveal a sustained policy of expansion which had for its goal the littoral of the Levantine Sea. The cost of these campaigns was amply covered by the enormous booty, ransoms, and tributes secured from the piedmont cities which studded the main line of march from the Assyrian frontier to the Phoenician ports.[54] The treasure in these cities, varied and abundant as it was, could not have been derived from the rather meager local resources of the district and therefore bears evidence to the immense profits procured from the passing trade.

Thus the little "land of the city of Assur" of 1500 B. C. expanded into the vast Assyrian Empire. The capital shifted upstream from Assur to Calchu, or Nimrud, in 1300 B. C., and in 1100 B. C. yet farther north to Nineveh, whose ruins lie opposite the present city of Mosul. Nisibis, owing to its location near the eastern end of the piedmont route, became an early outpost of Assyria when that state in the fourteenth century began to expand westward through northern Mesopotamia. A letter preserved in the Tell el Amarna collection, written by Assuruballit in about 1370 B. C. to the Pharaoh Amenophis IV, discusses the existing conditions of the road between Egypt and Assyria and complains that his mountain neighbor and commercial rival, the king of the Mittani, enjoyed special consideration in the Egyptian trade.[55] This letter indicates the ambition of the Assyrian king and the obstacles that lay in his path.

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[51] Winckler: Geschichte Babyloniens und Assyriens, pp. 144 and 153-154; G. C. C. Maspero: The Dawn of Civilization, New York, 1901, p. 564.

[52] Rogers, *op. cit.*, Vol. 2, p. 308.

[53] E. C. Semple: Influences of Geographic Environment, New York, 1911, pp. 234-238.

[54] Rogers, *op. cit.*, Vol. 2, pp. 64, 65, 75-76, 81, 96-97, and 225.

Assyria's Enemies

For the seven centuries of her westward advance, Assyria ran the gauntlet between enemies on the north and south who wished to get a foothold in the piedmont belt. From the south came repeated attacks from Babylon, several of which between 1300 and 960 B. C. succeeded in temporarily recovering Mesopotamia.[56] Moreover, the nomads of the grasslands were prone to encroach on the better-watered territory of the piedmont and constantly had to be expelled.[57] A decline of Assyrian power after the death of Tiglath-Pileser I enabled the Aramaean tribes of the Syrian Desert to push north and northeast into the Mesopotamian piedmont and the Naharina. They were drawn thither by the prospect of trade, for such nomads are natural middlemen. Hovering about the fringes of the cultivated land, they had probably furnished camel transport for the piedmont commerce or taken a hand in the caravan commerce down the Euphrates to Babylon. Now they established little independent states on the lower Khabur River, the Balikh, and on both banks of the Euphrates below Carchemish. Chief of these was Bit-Adini near Harran on the Balikh.[58] There they sought to maintain their independence against the attacks of Assyria, who tried to crush every rival middleman on the piedmont route. They were sustained by Babylon, who always hoped to reassert her claim to northern Mesopotamia; and they found a powerful champion and leader in Damascus, who, with the assistance of the nomads as well as the settled tribes, gravely threatened the western piedmont. When Assyria revived under Assurnazirpal (885-860 B. C.) it absorbed these little states, together with the Euphrates city Sura, river terminus of the desert route from Damascus via Tadmor.[59]

The piedmont belt was more seriously threatened from the north. It was repeatedly conquered in whole or in part by a succession of states which rose to power in the highlands of Armenia and the mountain ranges northwest of the great bend. These kingdoms, condemned by their rugged environment to backward economic development, based their meager national wealth on the raw products of forest, pasture, field, and mine. They wanted a frontage on the busy thoroughfare of the plain, in order to exchange their raw products for manufactured wares and share in the lucrative trade between East and West. This they achieved by conquering from time to time a section of the Mesopotamian piedmont, setting themselves up as middlemen and levying transit dues on the through traffic. Such were the Mittani, an Aryan people of the Armenian highlands, who about 1500 B. C. pushed their frontier southward over the rim of Mt. Masius and occupied the piedmont belt from Nineveh on the Tigris through Nisibis and Harran to the bend of the Euphrates.[60] Thus they got astride of the piedmont road and cut off Assyria and Babylon from the western trade.[61]

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[55] Rogers, *op. cit.*, Vol. 2, pp. 7-8; Winckler: History of Babylonia and Assyria, p. 189.

[56] *Ibid.*, pp. 93, 101, and 103.

[57] *Ibid.*, p. 104; Strabo, Bk. 16, Ch. 1, §26.

[58] Rogers, *op. cit.*, Vol. 2, p. 28.

[59] *Ibid.*, Vol. 2, p. 57-62 and 74: Winckler: Geschichte Babyloniens und Assyriens, pp. 176-188.

Assyria's Westward Expansion

In 1330 B. C. Assyria inaugurated her westward movement by expelling the Mittani from northern Mesopotamia. In 1270 B. C. Shalmaneser I consolidated the previous conquests, extended the frontier west to the Balikh River, if not to the Euphrates, and incorporated the city of Harran as his western capital on a par with Assur itself, to emphasize the union of the two states.[62] In order to secure the piedmont belt from attack, he conquered the Amida (modern Diarbekir) basin of the upper Tigris, advanced his frontier up to the main range of the Taurus on the north, which served as a border rampart, and planted Assyrian colonies through the newly acquired territories as outpost defenses of Mesopotamia.

This history repeated itself again in the reign of Tiglath-Pileser I (1170 B. C.), who pushed his way to the Mediterranean,[63] and with slight variations many times thereafter. Assyria during centuries of struggle for an open road to the western sea had constantly to beat back these mountaineers who threatened the right flank of her advance. Her main line of march was a corridor running along the base of their highland. Defeat involved withdrawal along this corridor, constantly exposed to flank attack. The semi-arid land south of the piedmont offered a difficult line of retreat in summer and a doubtful one in spring, when fodder indeed was abundant but when the widely flooded streams impeded the progress of an army. For military strategy this piedmont belt presented much the same problem as does the Venetian plain of northern Italy, between the Austrian Alps and the Adriatic, for an Italian army advancing from the Piave River to the Carso saddle. Therefore a mountain campaign in lower Armenia was the preliminary to every movement of Assyrian expansion along the piedmont belt.

This is the principle which emerges out of the fragmentary and confused accounts of the wars from the fourteenth to the seventh century B. C. The highland campaign usually started from Nisibis, which controlled a road leading northward through an easy pass in Mt. Masius to the basin of the upper Tigris and thence west into the Hittite country of Asia Minor.[64] The offensive often had to be pushed as far west as the Melitene district of Cappadocia and the Commagene country, because these mountain states enclosed on the north the strategic district of converging highways west of the Euphrates bend. They commanded the passes and roads leading down to the plain of Naharina, which in turn commanded the Mediterranean outlets of the piedmont road. The temptation to encroach was irresistible, because a few months of sovereignty there yielded a big revenue in transit dues and commercial profits. Hence these little mountain states often risked the wrath of Nineveh. In the time of Tiglath-Pileser III (745-727 B. C.) they combined with the Armenian state of Urarta and extended their conquests to include Carchemish and Arpad, until the Assyrian forces drove them back again.[65]

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[60] Eduard Meyer, *op. cit.*, pp. 672-673.

[61] J. H. Breasted: History of the Ancient Egyptians, New York, 1916, p. 212.

[62] Winckler: Geschichte Babyloniens und Assyriens, pp. 154-161 and 165.

[63] *Ibid.*, pp. 172-175; Maspero: The Struggle of the Nations, pp. 643-647.

STRUGGLE OF EGYPTIANS AND HITTITES FOR THE SYRIAN SADDLE

Assyria's progress along the piedmont was a halting one, an alternating advance and retreat, owing to these constant flank attacks. Difficulties increased, however, as she approached the Syrian Saddle. The strategic importance of this district as focus of the converging western roads made it the object of attack from all sides. Here competitors multiplied—a recurring crop which had to be cut down. Prior to the Assyrian advance, while the Mittani were establishing themselves in the Mesopotamian piedmont, Thutmose I of Egypt (1530 B. C.) inaugurated a policy of territorial expansion northward to the Syrian Saddle, in order to eliminate the western middleman from the Babylonian trade, which had already assumed importance for Egypt. He and his successors secured their hold on the Naharina and the Euphrates bend, dominated the trading town of Carchemish at the middle passage of the river, and established peaceful relations with their Mittani neighbors, as the interests of trade demanded.[66]

The Egyptians held this strategic area 150 years, till 1375 B. C., when they were dislodged from it by the Hittites, who had gradually been advancing southward from their mountain seat in eastern Asia Minor. They combined with their kinsmen, the Khati, who occupied the rugged mountains between the upper Pyramus River and the Euphrates above the great bend, invaded the Syrian Saddle district, and got astride of the Euphrates bend east to the Khabur River at the cost of the Mittani.[67] From this base they pushed their conquests up the Orontes valley, which formed the southern approach of the Syrian Saddle. Thus they gathered into their hands the whole traffic between Babylonia on the east and Egypt and Phoenicia on the west. Hittite remains have been found all along the route of the Bagdad Railroad from the Amanus Range tunnel to the Khabur River, at Sendjerle, Aleppo, Jerablus (Carchemish), and Ras-el-Ain;[68] the ancient stations are the modern stations. Remains also at Alexandretta indicate that this excellent harbor was the Hittite sea terminus of the piedmont road, as it will soon be the Mediterranean terminus of the railroad.

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[64] Maspero: The Struggle of the Nations, pp. 364-365.

[65] Rogers, *op. cit.*, Vol. 2, pp. 114-118.

[66] Breasted, *op. cit.*, pp. 212-234.

[67] Maspero: The Struggle of the Nations, pp. 364-366.

The Hittites had to defend their position in the Syrian Saddle against repeated attacks by the Egyptians, who suffered by their exclusion from the piedmont trade and under Rameses II, from 1288 to 1271 B. C., made a last sustained but futile effort to regain their lost advantage.[69] Soon afterwards the Hittites were assailed on the east by the rising power of the Assyrians, who for centuries battled to get and maintain their hold on the Syrian Saddle. They found it necessary to expand over the Amanus Range into Cilicia,[70] in order to control the northwestern approaches through the Cilician Gates and other Taurus passes of Asia Minor. Assyria was forced also to dominate the Phoenician littoral, which made large contributions to the piedmont trade, in order to reap the full profits of her position.

The Phoenician Cities

The distribution of the ancient Phoenician cities in relation to the Mesopotamian piedmont reveals a significant interplay of geographic factors, of geographical isolation and security versus geographical proximity and accessibility to an established trade route, of a location which gave protection versus a location which gave profits. According to every law of geographical probability, the Phoenician settlements spread originally all along this coast from Mt. Carmel to the head of the Gulf of Issus. Mövers maintains such a distribution on the basis of place names, religious cults, mythology, and legend, even for cities like Tarsus and Mallus, which have been attributed to Greek colonists.[71] It is just around the Gulf of Issus, with easy access to the Syrian Saddle and fair harbors at Alexandretta and the mouths of the Cilician rivers, that we should have expected the Phoenicians to place their commercial ports. On the evidence adduced by Mövers, so they did.

The persistent aggressions of the Babylonians, Hittites, and Assyrians, however, from 3000 to 605 B. C., jeopardized especially the northern seaboard towns which lay near the Mediterranean outlet of the piedmont route. The Amanus and Bargytus (Ansariyeh) Mountains afforded no adequate bulwark to settlements along their coast against rear attacks. Relative security could be found only along the littoral of the broad and lofty Lebanon Range. There the great and enduring Phoenician cities grew up, protected by their geographical location—Tyre, Sidon, Berytus, Byblus, Bothrys, Tripolis, Arka, and Simyra near the northern end of the Lebanon Range. The location of all these cities was the resultant of two divergent geographic forces; it combined sufficient proximity to the piedmont road for participation in its trade, and sufficient remoteness combined with protected sites to insure the peace necessary for early industrial and commercial development. The sole exception to the rule is the conspicuous proof. That was the city of Arvad or Aradus, situated on a little island four miles off the Ansariyeh Mountains coast, about 30 miles north of Tripolis. When no war clouds hung on the land horizon, its citizens occupied a twin settlement on the coast called Antaradus and cultivated their terraced gardens while they gathered in Oriental merchandise from the inland trade routes; but, when the Assyrian wolf pack burst through the passes in the mountains, the people scurried into their boats and took refuge in their rocky island; there, Manhattanwise, they tucked themselves away in their ancient skyscrapers.[72] An Assyrian attack on the coast settlement of Aradus was the signal to the southern Phoenician cities to mobilize their forces for defense. Conquest was followed by a period of tribute paying, then by a period of successful revolt and independence, because the long reach from Nineveh to Tyre weakened the arm of Assyrian authority.

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[68] D. G. Hogarth: Article "Hittites," Encyclopaedia Britannica, 11th edit., 1910.

[69] Breasted, *op. cit.*, pp. 280-285 and 428-430.

[70] Winckler: Geschichte Babyloniens und Assyriens, pp. 192-198, 223-226, 241-244, and 255-258.

[71] Mövers, *op. cit.*, Vol. 1, p. 404; Vol. 2, pp. 50-51 and 166-174.

The Gulf of Issus, before the Greek period, was not permitted to breed on its shores the goose that might lay the golden egg of maritime commerce. Undoubtedly the goose was hatched again and again, built its nest, and then was destroyed. The easy seizure of the Phoenician city of Myriandros, located on the Amanus littoral near the foot of the Pylae Syriae (Beilan Pass, 2,395 feet), when Cyrus the Younger marched through in 401 B. C. for his invasion of Babylonia, shows how exposed was the location.[73] Alexander the Great planned Alexandretta on the basis of a unified political control from the Mediterranean to the Persian Gulf. We are forced to think with Mövers that very ancient Phoenician towns occupied the approximate locations of Antioch and Seleucia, which the Seleucids built as the Mediterranean outlet of the piedmont road. Situations so promising could not have been overlooked. They were apparent to Antigonus, who built the town of Antigonea five miles upstream from the later Antioch,[74] near the site of the old Phoenician Heraclea. Seleucia also occupied the exact site of an earlier settlement,[75] and it faced, across the little Bay of Antioch at the foot of Mt. Casius, the ancient port of Posidium, probably of Phoenician origin. On this marine inlet lay the city of Kundu in 670 B. C., an ally of

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[72] Strabo, Bk. 16, Ch. 2, §§ 13 and 14.

[73] Xenophon: Anabasis, Bk. 1, Ch. 4.

[74] Diodorus Siculus, Bk. 20, Ch. 47; Strabo, Bk. 16, Ch. 2, § 4.

[75] Strabo, Bk. 16, Ch. 2, § 8.

Sidon and undoubtedly the seat of a Phoenician factory, which was seized by the Assyrians under Esarhaddon.[76] Thus these northern Phoenician settlements were destroyed or overlaid by Greek colonies, while the southern ones proved the law of the survival of the fittest, geographically speaking.

The Seleucid Kingdom

The Seleucid kingdom succeeded Alexander's rule in this transit region between the Mediterranean and the Persian Gulf, and it fattened on the trade which streamed along the piedmont road and out to the sea by Antioch and its port Seleucia. Like previous incumbents of the Syrian Saddle, it had to defend its strategic position against attacks from several sides; but it enjoyed this advantage, that Antioch and "the land of the rivers" formed the center and not the periphery of its domain, as was the case with the ancient Egyptian, Hittite, and Assyrian possessors of this focal district.

Egypt never through the ages lost her interest in the Syrian Saddle; nor has any modern dynasty or power, native or foreign, which has fallen heir to the throne of the Pharaohs. Control of the Suez or the Nile-Red Sea route to the Orient seems to have aroused a desire to control the Mediterranean outlet of the competing Mesopotamian route. The effort of the Eighteenth Dynasty to get astride of the Euphrates bend was repeated by Necho in 605 B. C., and this ambition colored the Asiatic policy of Egypt in the intervening centuries. It animated also the Ptolemies in their attacks upon the Seleucid power in Palestine, Syria, and Cilicia. Ptolemy II in 246 B. C. captured Antioch and Seleucia, Syria, Cilicia, "and the upper districts across the Euphrates."[77] He was unable long to hold all this territory but significantly enough he kept the seaport Seleucia in his grasp for twenty-five years.[78]

The Rise of Armenia

The declining power of the Ptolemies ceased to threaten the Seleucid state, which was also declining. At the beginning of the first century B. C. it had withdrawn to the west of the Euphrates before the advance of the reviving Persian or Parthian kingdom and soon was forced to defend its frontier along the Euphrates bend against a new enemy. The rising kingdom of Armenia, under its king Tigranes, had pushed its frontier south over the rim of its highland, and incorporated the Mesopotamian piedmont belt from Nineveh and Nisibis in the east to the old Carchemish district in the west.[79] It thus repeated the territorial expansion of the Mittani kingdom fourteen centuries before and with the same purpose—to get a frontage on the piedmont road. To emphasize the new outlook, the king built a new capital, Tigranocerta, up in the foothills of Mt. Masius about 40 miles northwest of Nisibis; and he settled a tribe of Arab nomads in the Harran and Edessa (Urfa) districts, where they commanded the piedmont route and the chief fords or ferries of the Euphrates bend, so that they might collect transit dues for him.[80] To get outlets to the Mediterranean, he seized Antioch, northern Phoenicia, and eastern Cilicia but failed to hold them long. When Lucullus with his Roman legions pushed the Mithridatic war into Armenia in 69 B. C. and captured Tigranocerta and Nisibis, he found there treasure[81] which recalls the riches of the piedmont cities in ancient Assyrian days.

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[76] Rogers, *op. cit.*, Vol. 2, pp. 223-225.

[77] J. P. Mahaffy: The Empire of the Ptolemies, London, 1895, pp. 34-35, 82, 87, 197, and 200.

[78] Polybius, Bk. 5, Chs. 59-60.

[79] W. R. Shepherd: Historical Atlas, New York, 1911, p. 33, map 2.

THE ROMAN ADVANCE

The Roman advance eastward, like the Assyrian advance westward, had to push its way between the enemy of the mountains and that of the plains, Armenians and Parthians, who came to make common cause against the Roman intruder. Every Roman offensive began with a campaign in highland Armenia, which automatically threw the piedmont belt into Roman hands. Highland Armenia, after its conquest, was allowed to fall away; but the piedmont was retained and therewith the great traffic route between East and West. The several Euphrates fords or ferries, Carrhae (Harran), Resaina, and Nisibis, became familiar with Roman merchants traveling to and from the East, Roman customs officials, and Roman armies bound towards the Tigris road on their way to Ctesiphon; for Parthian attacks were incessant. Nisibis was a Roman frontier fortress from 115 to 363 A. D. and the regular base of operations against the Parthian capital on the lower Tigris.[82] As the Empire declined, her eastern frontier fell back only a few miles behind Nisibis. The Patriarchate of Antioch reached from the Mediterranean to the Khabur River in 638 A. D. when the Saracens came.[83]

THE CRUSADERS

After the Saracen conquest of Syria and Mesopotamia, traffic moved busily east and west along the piedmont road. The Arab geographers of the eleventh and twelfth centuries give glowing descriptions of its thriving cities with their irrigated fields, gardens, orchards, and vineyards, their crowded mosques and markets, as these existed under the Seljuk Turks in 1100 A. D.[84] Then the Crusaders came. With purpose more commercial than religious, they aimed directly for control of the Syrian Saddle. From 1098 to 1268 we find one noble house of Crusaders established in the Principality of Antioch, extending from the Bay of Alexandretta and Laodicea east across the Orontes valley nearly to Aleppo (Fig. 4). This principality marched on the northeast with the County of Edessa (1098 to 1144), which stood fairly astride of the Euphrates bend, the upper Balikh and the upper Khabur, embracing the old district of Carchemish, Edessa, and the northern ford of the Euphrates at Samosata. The Crusaders' County of Tripoli included all the old Phoenician coast land from Aradus south to Berytus (Beirut).[85] There was keen competition among the Knights of the Cross for these profitable gateways to the East, but the throne of Jerusalem went begging.

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[80] Theodor Mommsen: The History of Rome, New York, 1905, Vol. 4, pp. 315-317 and footnotes.

[81] *Ibid.*, Vol. 4, pp. 339-341.

[82] Mommsen: The Provinces of the Roman Empire, Vol. 2, pp. 72-73, 84-85, 94-95, and 98.

[83] Shepherd, *op. cit.*, p. 52, map.

[84] Le Strange, *op. cit.*, pp. 87-108.

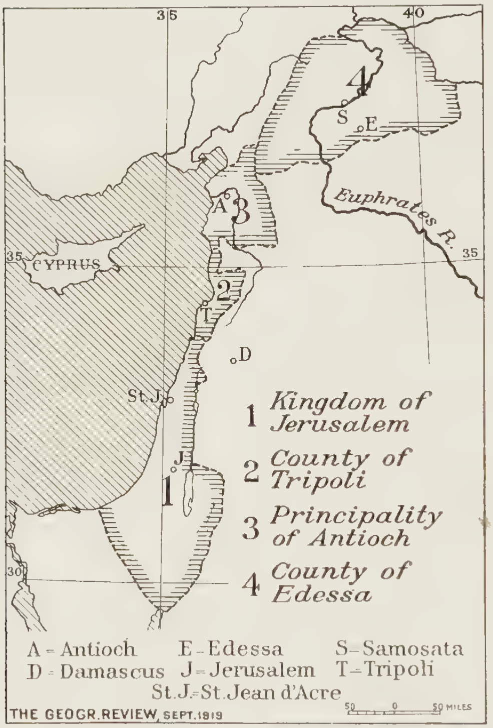

FIG. 4—(Slightly modified from Fig. 1, *Geogr. Rev.*, Vol. 1, 1916, p. 292).

EGYPT AGAIN

It was Egypt again, under the rule of the Mameluke Sultans, who next occupied the Syrian Saddle. By 1268 they held Antioch and Aleppo to the Euphrates bend, and gradually controlled the whole saddle. For over two hundred years it was theirs, while they advanced their frontier over Cilicia to the Taurus crest as a defensive boundary against the Ottoman Turks on the northwest. Very significantly, the Venetians, who since the Turks got astride of the Dardanelles (1356) were concentrating their trade at Alexandria and developing the Nile-Red Sea commerce with the Orient, in 1489 occupied Cyprus, apparently for nearer access to the competing piedmont route, whose outlets now were also in the hands of the friendly Egyptian government.

CYPRUS

It is a notable fact that all through history designs upon the Syrian Saddle, whether commercial or political or both, have been inaugurated or accompanied by the acquisition or occupation of Cyprus. Immediately after

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[85] Shepherd, *op. cit.*, p. 68, map.

England in 1876 secured the controlling interest in Suez Canal stock through the agency of Disraeli, through the diplomacy of the same statesman she secured Cyprus (1878) and thereby control of the sea approaches to the possible Mediterranean termini of any future Bagdad railroad. The very outline of Cyprus suggests a hand pointing a pistol at the Bay of Alexandretta and the Orontes mouth.

SCIENTIFIC RESULTS OF THE SECOND THULE EXPEDITION TO NORTHERN GREENLAND, 1916-1918*

I

MIGRATION ROUTES OF THE ESKIMOS IN NORTHERN GREENLAND

By KNUD RASMUSSEN

ESKIMO HOUSE RUINS

The Second Thule Expedition had as one of its main objects the search for traces of earlier Eskimo migration. We found on our way from Etah to Humboldt Glacier an amazingly large number of ruins of earlier Eskimo buildings. Not less than nine settlements south and one north of Humboldt Glacier were determined, with a total of 60 houses. Wherever possible the ruins were measured. Regular excavation could not be undertaken on account of the extreme cold, as we passed the ruins at the beginning of April. Everything was covered with deep snow. Doubtless an examination undertaken in July or August would bring good results and give an opportunity to find more houses. I have been informed by Eskimo bear-hunters that settlements could be found far up Advance Bay, into which the expedition was not able to go, as it would have led too far away from the main route.

All measurements of house ruins proved them to have been extraordinarily small, evidently because of lack of building material. In order to build a real Eskimo house of stone, the material always used, one needs large, solid, and, if possible, flat stones. But as the rocks here consist of sandstone, only to be found in scattered pieces, it was impossible to build larger houses, even if the hunting conditions would have allowed such extravagance. This assumption is proved to be right by the fact that the houses near Rensselaer Bay and Marshall Bay were larger than all the others, because here were found gneiss and granite rock, while the hunting conditions were not better than where we found only small houses. In addition there were some peculiar fox traps, which were built in the manner of a cairn, sometimes 170 centimeters high, called *uvdlisatit;* these are no longer in use but are well known to the Eskimos. The name expresses the fact that one does not need to look after them every day.

The foxes were caught in the following manner: A decayed seal is placed at the bottom of a hollow stone cairn, while the entrance is covered with willow twigs that are smeared with blood. The trap is built in a manner that makes it impossible for the fox to escape after he has jumped into it; and in this way several foxes can be caught in a few days.

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* The second of two articles presenting the results of the Second Thule Expedition, translated and condensed from the report published in the *Geografisk Tidskrift*, Vol. 24, 1917-18, pp. 215-232. The first article, containing the narrative of the expedition by Knud Rasmussen, with map, appeared in the August *Review*.—EDIT. NOTE.

The houses north of Humboldt Glacier were found in Benton Bay, about 12 kilometers distant from Cape Clay. In addition numerous tent rings and very large meat caches were discovered. The houses were built on gravel and small stones. The material was exclusively of stones, which were long and flat and sometimes rather large. In only one house we found that whalebones were also used. Several houses had remarkable forms; one of them was almost square, evidently on account of unfavorable material, poor rock, and lack of turf for pointing. The meat caches had the same forms and sizes as those we had measured and sketched on Blochs Island in Melville Bay.

The living conditions seem to have been splendid in this region. Many seals were observed, especially in the spring and the fall, and the ice around Humboldt Glacier gives good opportunity for bear-hunting. These house ruins in Benton Bay were the most northerly that were found by the expedition on the coast of Greenland. A thorough examination of the coast and the ice-covered land, with the assistance of our four Greenlanders, failed to produce any signs of an earlier building.

IMPROBABILITY OF ESKIMO MIGRATION AROUND NORTHERN GREENLAND

Even in the large fiords, especially Sherard Osborn Fiord and Victoria Inlet, where we were convinced we should find house ruins, not one was discovered, in spite of the fact that our hunting trips, both going and coming, brought us to all accessible places in the region. It is my confirmed opinion, as a result of my experience on this expedition, that there has never been any migration of the Eskimos around the north of Greenland. My reasons for this are briefly:

(1) On the entire northern coast no tent rings, fire places, or other marks of Eskimos are to be found. All places that necessarily would have had to be used for hunting during a migration were thoroughly examined. The people on a migration with their women and children would not have gone deliberately into difficult regions. Pack ice from Polaris Promontory to Sherard Osborn Fiord would have offered a considerable obstacle to the transport of families and household furnishings.

(2) The Eskimo migrations were not due to nomadic instinct but mostly—when enemy neighbors were not the compelling reason—to the desire to reach more favorable hunting grounds. The peculiar ice and snow conditions on the northern coast of Greenland make hunting on the sea impossible, and the ice-free coast areas are not large enough to furnish sufficient game to stationary or wandering tribes.

> (3) Besides this, the distances here are very great. From the tent rings near Hall's grave—the most northerly known tent rings on the western coast of Greenland (81⅔°)—to the tent rings near Independence Fiord—the most northerly known on the eastern coast—the distance which would have had to be covered by an Eskimo family is not less than 1,000 kilometers.

Taking up the last point in greater detail: From the houses in Benton Bay (80°), the most northerly known on the western coast of Greenland, to the houses near Mallemuk Rock on the eastern coast (80⅓°), the distance to be covered by sledge is not less than 1,500 kilometers, about the same as between Upernivik and Julianehaab. An Eskimo family, to cover this distance with its necessary paraphernalia and primitive hunting apparatus, would be forced to make stops at places where there were good hunting opportunities. The distances that are covered in a year, or, rather during the spring, are without doube very short. Besides, it is necessary for the wandering family to have the impression that the hunting conditions will improve from day to day.

Our expedition, which consisted of picked men equipped with the best weapons, had great difficulty in returning from these game-poor regions under the most favorable conditions of the season. I cannot believe that the climatological conditions and therewith the hunting conditions were different at the time the Eskimos undertook their migrations. The large fiords, St. George Fiord, Victoria Inlet, Sherard Osborn Fiord, Nordenskiöld Inlet, and all the other larger or smaller inlets as far as De Long Fiord, were filled with flowing inland ice, and nowhere on land were the conditions favorable for the existence of animals that would have permitted a family to stop for the winter.

The Eskimo members of our expedition were very unfavorably impressed by the bad conditions for seal-hunting and the poor material for building purposes, as the whole coast consists of loose shaly sandstones. They, like myself, were convinced that no Eskimo family would have dared to settle down on this coast.

In my estimation the natural conditions in the most northerly part of Greenland make an Eskimo migration from the western coast to the eastern coast by this route impossible. Granted that the climatological conditions and therewith the conditions for hunting were better at the time the Eskimos migrated—contrary to my belief—I do not think it possible that such migration could have left such slight traces as not to be discovered by the thorough examination of all the regions in every direction by our expedition.

Hitherto it has been believed that the Eskimos crossed over to Independence Fiord on the inland ice back of Peary Land proper. This would be impossible, as the existing conditions do not allow an ascent from the head of any of the fiords up to the inland ice. No Eskimo will undertake a journey of 200 kilometers on the inland ice with wife and children, without knowing the natural conditions of the ground to be covered. A migration from northwestern to northeastern Greenland was impossible.

My belief is that several excursions were made to the north or east either from the winter houses near Lake Hazen on Grant Land or from Cape Benton; the tent rings near Polaris Promontory originate from such excursions. The unfavorable ice and hunting conditions were soon discovered, the route was given up, and the people went to Melville Bay, which is more thickly settled and has the most nearly ideal hunting conditions of all Greenland. From here they have scattered southward over all Greenland to Cape Farewell and from there followed the eastern coast. From the large settlement in the Angmagsalik district came the other Greenlanders all the way up to Mallemuk Rock, and from excursions and reconnoitering trips of these Greenlanders originate the tent rings found in Independence Fiord. At a later date I shall explain my opinions in detail and I will say only this in concluding my sketch:

One should be cautioned not to attach too much importance to the fact that musk oxen in small herds have migrated to the eastern coast around the north of Greenland. One is not warranted in deducing from this fact alone the conclusion that the Eskimos were able to procure food by which they could skirt northern Greenland and migrate down along the eastern coast.

II

BIOLOGICAL OBSERVATIONS: PRELIMINARY ACCOUNT OF DR. WULFF'S RESULTS

By C. H. OSTENFELD and MORTON P. PORSILD*

Dr. Thorild Wulff's diaries and the collections we brought home show how much science has lost through his death; up to his last breath he made observations and sketches of the plant and animal life.

The last record in his diary says what another cannot express; he wrote (in Swedish):

> Straining march until August 29 . . . . 12.30 A.M. without finding food. I am half dead, but found a little Woodsia fern. I lay down 7 P.M.; will not be a hindrance to my comrades' rescue. . . . .

Every page of his diaries proves the energetic spirit in which Wulff worked to procure valuable results for the expedition. Science owes this man much; and Sweden, his fatherland, and Denmark, to which he offered his last work, can be proud of what he did during a daily fight against death, that lasted almost three months.

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* Dr. Porsild, Director of the Danish Arctic Station on the island of Disko, has looked over the diaries of Dr. Wulff and has written an account which I have used in connection with my own impressions, after looking through our collections, for a summary of the biological results.—C. H. O.

Dr. Wulff's Botanical Observations

The value of Wulff's collections can only be judged after closer examination; but, inasmuch as very little is known of the zoölogical and botanical life of these regions, these observations must be of great scientific interest. Already the preliminary examination of the dried flowering plants has established the existence of several interesting and geographically important species, as *Minuartia* (*Alsine*) *Rossii* and *Erigeron uniflorus,* which were found on the northern coast of Greenland.

It may be said that Wulff's botanical collections complete the floral examination of Greenland. Plant geographical variations will naturally be added in the future but will not increase the known flora of Greenland considerably, since almost the whole coast has now been visited by botanists. In regard to the lower-class plants and animals our knowledge is much less, and therefore Wulff's collections will produce new views, especially concerning geographical distribution. In addition to this, it must be mentioned that the geologist of the expedition, Lauge Koch, partly assisted by Peter Freuchen and the American explorer Ekblaw, made a quite complete collection of flowering plants from the environs of Thule (Wolstenholme Sound) in 1916 that will be valuable to plant geography.

At the beginning of June Wulff visited the coast of Markham Island (east of Elison Island, 83°), with its relatively rich vegetation, but had to return after some time for lack of game. Here at Markham Island, at the most northerly point he reached, which was near Low Point, he built a cairn in which he placed an account for the leader of the expedition, and on June 13 he planted the yellow-blue flag of his country on the top of the cairn, proud of the fact that he had brought it farther north than it had ever been brought before.

The biological results comprise: (1) Dr. Wulff's well-kept diaries and (2) the collections.

The Diaries

The diaries contain, besides an account of the route of the expedition, notes on weather conditions, photographs, etc., also physiologic-psychologic reflections on the deteriorating effect upon himself of fatigue and hunger.

Zoölogy

The zoölogical descriptions contain observations of the animals that were encountered by the expedition, especially of mammals and birds, and also fishes and animals of a lower order. Wulff was very desirous of finding out the conditions of life of the animals. He observed their methods of procuring food, the contents of their stomach, their propagation, and other biological matters, and tried to establish the temperature of the blood of some Polar animals.

Botany

Wulff's main botanical work was performed on the northern coast of Hall Land and farther north. He had to collect his material under quiescent winter conditions and was able only partly to identify the material on the spot. Therefore his diaries do not give an exact account of all he found. It seems that, in the very short time he worked, he had collected all higher-class plants that could be thought to exist there and several rare extreme arctic types, whose existence he established. Sixty-six species of higher-class plants are discussed in the diaries, and the working out of his collections will doubtless produce a greater number. Hitherto only 29 species were known from Humboldt Glacier northward. The diaries contain many observations on botanical conditions in extreme temperatures and on the biology of nutrition and reproduction.

Wulff made serial measurements of the temperature of and near the vegetating plants. It is of special interest that he was able to establish a total absence of higher plant life on the large 780 meter-high land inside of the inland ice belt which the expedition crossed on the return. Only a few species of moss and lichens were found; these did not grow on the calcareous ground but only on loose blocks of gneiss and diabase. Animal life even of a lower order could not be detected. So far no land in the northern hemisphere has been found to be so bare of life, and its like is only known on the Antarctic Continent. Wulff's observations will therefore be of the greatest interest in relation to the fate of the Greenland flora during the Ice Age.

After descending from the inland ice, Wulff found that the vegetation at the easterly end of Inglefield Land was far richer in species and in much better condition for examination. This part of Inglefield Land has hitherto been unknown botanically, while the more easily accessible western side has been well examined and shows a flora of 82 species.

The Collections

The collections comprise:

(a) A rich and beautifully prepared collection of flowering plants, mosses, and lichens, some species of algae and parasitic fungus and sponges.

(b) Several prepared birds, birds' eggs, some marine animals, many insects, and no small number of intestinal parasites of higher-class animals.

(c) Specimens of the soil and the contents of stomachs, taken for bacteriological examination.

(d) Specimens of sea water and plankton, collected to the depth of 400 meters on the voyage up from Disko to Thule in the fall of 1916. Examination of the water and the plankton will surely be of great interest, as the sea north of Disko has been little known from this standpoint.

III

GEOGRAPHICAL POSITIONS

By LAUGE KOCH

In regard to the cartographical results I refer to the geological map,[1] on which all geographical corrections and new discoveries are indicated. Only a few latitudes were calculated, and the larger part of the material has not yet been worked out. From the northern coast we obtained about 40 observations of latitude, about 80 determinations of azimuth, and about 40 determinations of longitude. The time was kept from Etah and return, during the whole voyage, without mishap. About 120 sketches and sights of land for cartographical and geological use were brought back. About 150 altitudes were determined trigonometrically.

IV

SUMMARY OF GEOLOGICAL RESULTS[2]

By LAUGE KOCH

STRATIGRAPHY

On the way up through Smith Sound and Robeson Channel one passes from south to north Archean, Algonkian, Cambrian, Silurian, and probably Devonian formations. A closer view shows that the strata extend across northern Greenland, forming belts in which one layer follows the other and the most recent are to be found farthest north. Archean formations are found in Melville Bay and toward the northeast. Algonkian strata are established in the region of Wolstenholme Sound-Inglefield Bay, south of St. George Fiord, and in the region Danmark Fiord-Independence Fiord. The strata consist of sandstone and limestone with ripple marks and diagonal structures. Some places show strong diabase eruptions. I found Cambrian slates near Cape Constitution (80½°). The fauna contains the same species as are found in northern Europe and New Brunswick. Silurian limestone exclusively from the lowest and middle Gotlandian is found in Washington Land, Hall Land, and towards Peary Land. Pentamerus lime and Rastrites slate (Clinton) underlie the limestone and Monograptus slate (Niagaran). The fauna resembles that of northern Europe, northern Asia, and northern North America. Green slates overlie the Silurian series. On the northern coast of Greenland these are folded into a mountain chain, which forms, with the Victoria and Albert Mountains of

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[1] Its topographical outlines are reproduced on the map accompanying the first article, in the August number, p. 118.—EDIT. NOTE.

[2] A translation of the geological results, as given *in extenso* in the Danish original, is to appear, it is understood, in the *Journal of Geology*.—EDIT. NOTE.

Grinnell Land, a folded chain about 1,000 kilometers in length. The mountains are residual in character, and the folding that gave rise to later elevation probably originates from the second half of the Paleozoic Era. These layers prove a Paleozoic transgression, the largest known in Greenland. Its development is mainly the same as it is in Arctic North America.

Postglacial Formations

Up to the present no postglacial formations were found in Melville Bay. Postglacial formations in the Cape York district and on Washington Land are poorly developed. Deltas are found at the valley mouths; the highest of these reaches 160 meters. In many places old Eskimo houses fall into the sea, which may prove that the subsidence in Danish Greenland also takes place in the Cape York district. Alluvium is relatively widespread on the northern coast of Greenland. A lowering of 50 meters would submerge 2,000 square kilometers that are covered by marine layers. Marine formations with shells go up to a height of 135 meters. Strand lines are found up to a height of 210 meters. The northern coast was not more ice-covered when it was 100 meters lower than it is at present.

Glaciology

The belt of rocks and islands that gird the coast between Holms Island and Cape York are covered by low inland ice that leaves only the outer islands free. The inland ice in the Cape York district is apparently only in slow movement. Ice cracks are rare, a fact that is very important from the standpoint of communication between settlements. In a few places a strong advance movement has recently taken place in the glacier ice. The Humboldt Glacier can be considered as the edge of the inland ice, occupying a plain the edge of which is overflowed by the sea. Ice cracks are not to be found.

In Sherard Osborn Fiord, Victoria Inlet, Nordenskiöld Inlet, and in one arm of De Long Fiord flowing inland ice was observed. Southwest of St. George Fiord are large ice-free regions, while the regions toward Peary Land are thickly covered with ice. The northwesterly parts of Peary Land are ice-free, with the exception of a few local glaciers. These show signs of having had the same extent for a long period; there were found no proofs that they have either enlarged or decreased in size.

A NEW CLASSIFICATION OF CLIMATES

By ROBERT DeC. WARD
Harvard University

[With separate map, Pl. II, facing p. 188.]

It may truthfully be said that of the making of classifications of climate there is no end. An almost infinite number may be proposed, for the basis of subdivision may be the special conditions of any one climatic element; or similar combinations of two or more elements; or, again, the distinguishing characteristics may be found in botanical or in zoölogical relations. In a previous discussion by the present reviewer, the most important classifications of climates suggested before 1906 were considered.[1] A further paper dealt chiefly with the "thermal regions" suggested by the late Dr. A. J. Herbertson.[2]

Köppen's Classifications of 1900 and 1918

Among the numerous classifications of climate hitherto proposed, that of Dr. W. Köppen is especially noteworthy because of its emphasis upon certain critical and clearly defined underlying controls which serve as the basis of the subdivisions, because of the care with which these fundamental controls are worked out, and because of the simple way in which they are expressed.[3]

After an interval of nearly twenty years, Dr. Köppen now gives us a new, thoroughly revised classification,[4] which is clearly the result of further very searching analysis of all the most critical climatic controls, as well as of a study of other classifications which have been suggested during the intervening two decades, viz. those of De Martonne (1909), Penck (1910), Hettner (1911), and Drude (1913).

A comparison of Köppen's earlier map with the new one shows many resemblances, both in the larger climatic belts and in the smaller subdivisions. There are also certain broad resemblances in the general scheme of fundamental controls selected as the basis of the subdivisions. The new scheme is based upon temperature, rainfall, and seasonal characteristics. The critical features of the various combinations of these controls are worked out with great accuracy and detail, and a brief, simple, and easily remembered scheme of letters and numbers—of "climatic formulae"—is used for the characterization of each climatic subdivision. One point in connection with this classification which deserves special mention is the fact that the oceans are included in it. This is one of the distinctive features of the new scheme, as it was of the original map of 1900, and adds greatly to its interest and value. The 1918 map is much more than the conventional "new edition" of the earlier one. It is not possible, in a brief note, to do justice to so elaborate a scheme as that which Köppen brings forward. A careful study of the original paper is essential if an adequate appreciation of the importance and the significance of the new classification is to be gained.

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[1] R. DeC. Ward: The Classification of Climates, *Bull. Amer. Geogr. Soc.*, Vol. 38, 1906, pp. 465-477.

[2] *Idem:* A Note on the Classification of Climates, *ibid.*, Vol. 46, 1914, pp. 108-116.

[3] W. Köppen: Versuch einer Klassifikation der Klimate, vorzugsweise nach ihren Beziehungen zur Pflanzenwelt, *Geogr. Zeitschr.*, Vol. 6, 1900, pp. 593-611, 657-679, with Pls. 6 and 7. The map has been reproduced in *Bull. Amer. Geogr. Soc.*, Vol. 38, 1906, opposite p. 468, and also in R. DeC. Ward's "Climate Considered Especially in Relation to Man," 2nd edit., 1918, p. 69.

[4] W. Köppen: Klassifikation der Klimate nach Temperatur, Niederschlag und Jahresverlauf, *Petermanns Mitt.*, Vol. 64, 1918, pp. 193-203 and 243-248, with map and diagrams.

THE SCHEME OF CLASSIFICATION OF THE 1918 MAP

The fundamental zonal subdivision between equator and poles is in six broad belts, distinguished by capital letters, as follows: A, tropical rainy climates; B, dry; C, warm temperate, rainy; D, sub-arctic; E and F, snow. A is the megathermal zone, lacking a winter; C, the mesothermal, or warm temperate; and D the microthermal, with cold winters. Between A and C is the dry zone, B. The tundra belt is E, and the permanently frozen belt is F. These six larger zones are next subdivided into eleven provinces (1-11), beginning at the equator and clearly differentiated on the map by colors, red being used for the warmest, blue for the coldest, yellow for dry, etc.[5] The critical temperature, rainfall, and seasonal characteristics are worked out in detail, and a further scheme of small letters and of exponents is developed which makes possible the use of the series of simple and exact formulae, above referred to, which express the essential characteristics of each climate. Some of these designations are as follows: a = mean temperature of warmest month over 22° C.; h = mean annual temperature over 18° C.; n = frequent fog; n′ = fogs rare, but high relative humidity without rain and relatively cool (summers below 24° C.); s = driest season in summer; w = driest season in winter.

EXAMPLES OF CLIMATE CHARACTERIZATIONS

As an illustration of the simplicity and the completeness of this method of designation we may take the province which includes most of the southeastern United States. This is No. 7 (damp temperate) and is shown in pink. Its formula is Cfa, i. e. (1) the warm temperate belt (C); (2)

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[5] The meanings of the several numbers are as follows:

1. Hot, damp, primeval forest climate
2. Periodically dry savana climate
3. Steppe climate
4. Desert climate
5. Warm climate, with dry winters
6. Warm climate, with dry summers
7. Damp temperate climate
8. Cold climate, with dry winters
9. Cold climate, with wet winters
10. Tundra climate
11. Perpetual frost climate

always well watered, with sufficient rain and snow in all months (f); (3) mean temperature of warmest month over 22° C. (a).

Or, take Yuma. This is No. 4 (desert). Its formula is BWh. This means (1) the dry zone (B); (2) desert (W); (3) mean annual temperature over 18° C. (h).

The Present Reproduction of the 1918 Map

Plate II is a somewhat reduced reproduction, in black and white, of Köppen's colored chart. An attempt has been made to render the symbolism of the color scheme by means of rulings and stipplings. Hot and warm climates are shown in single rulings, semi-arid and arid in stipplings, and cool and cold in cross rulings, the depth of tone decreasing from both extremes of the scale toward the arid desert climate as a minimum. In a very few cases restricted areas of special climatic type, as in higher mountain regions, have been omitted.

Other Features of the Classification

Regarding the names of the various climates, Köppen suggests, as in his earlier scheme, the use of the general terms tropical rain forest, savana, steppe, etc.; of distinguishing forms of vegetation, e. g. oak, birch, etc.; and of descriptive terms such as damp temperate, etc. Again, following the plan of his earlier paper, Köppen shows the ideal geographical distribution of his climates diagrammatically, over a continent stretching from pole to pole. His diagrams include further a comparison of the temperature conditions in the two classifications, the annual migrations of the regions of high and low pressure and of aridity, and the pressure distribution in January and in July over both hemispheres.

Köppen's Comments on Climate and Civilization

The causal interrelations of the various climates are clearly set forth, and, in conclusion, there are some interesting comments on the climates of the geological past, on climate and soils, and on climate and civilization. Certain significant statements are made under the latter headings. For example:

> In the reconstruction of the climates of the past, the less such climates find support in present conditions, the greater caution should be exercised. Assumptions which rest upon a radical rearrangement of the general atmospheric circulation, and on the mean pressure distribution associated therewith, surely need to be supported by strong proofs.

And:

> The oldest civilizations developed in the climates of group B (arid) and on their margins: Egypt, Syria, Mesopotamia, portions of India and of northwestern China in the Old World, and in Mexico and Peru in the New World. . . . . The conditions for the development of these civilizations were found in irrigation, which makes possible a peaceable, well-regulated, and close association of many people, for it insures abundant crops as long as man submits to a well-organized common life and as long as he does not relax in his labor.

From early days, the centers of highest human development have gradually been displaced from the irrigated lands of lower latitudes to the cooler and rainier regions. Many dangers and difficulties are present in a modern highly developed state.

> The development which has led mankind from Babylon to London has in certain respects probably gone too far. On the one hand, it may be observed that too exclusive a concentration upon industry and trade in any country carries with it great dangers, and, on the other, with the aid of modern science and technical skill, we are again coming to practice agriculture under irrigation, instead of in conditions of uncertain natural rainfall. Thus the warm and sunny lands will regain some of the advantages which they have lost to the colder and damper climates, precisely in proportion to the degree with which man's scientific and technical skill succeeds in overcoming the difficulties of transportation and in mastering tropical diseases.

The foregoing comments will serve to indicate the underlying principles which have guided Dr. Köppen in the development of his new classification. No one who makes a close study of the author's discussion and of his map and diagrams can fail to realize how thorough, how systematic, and how *climatically sound* is the scheme. As a framework for studies of the climatic controls over the distribution of life it will prove of great value to students of botany and of zoölogy and to all who are concerned with the relations of man and his geographic environment. Those who are dealing with climates in any of their manifold aspects and relationships will find it a means of systematizing and of correlating their knowledge on a thoroughly scientific climatological basis.

GEOGRAPHICAL RECORD

NORTH AMERICA

Temperature Influence on Dates of Planting and of Harvesting in the United States. The detailed investigation of the influence of weather controls over agricultural operations in the United States is yielding valuable results of immediate practical economic importance to American farmers. A recent study, by Joseph B. Kincer, of the U. S. Weather Bureau, entitled "Temperature Influence on Planting and Harvest Dates" (*Monthly Weather Rev.*, Vol. 47, 1919, pp. 312-323), adds another interesting chapter to this subject.

There are naturally certain restricted time limits within which crops should be planted in order to secure the best results, these limits being defined by the temperature conditions of the locality. The length of the period within which the planting of a given crop may be accomplished decreases in general with increase in latitude. As a rough measure of the amount of heat required after planting to bring a crop to maturity, the accumulated day-degrees of temperature above the mean temperature at which planting is accomplished may be taken. It is suggested that the mean temperature at which the planting of a given crop can be accomplished be used as a base, or starting point, for any method that may be employed for temperature summation. Spring wheat seeding usually begins in the Dakotas and in Nebraska when the normal daily temperature rises to 37° F. and in Minnesota and Wisconsin when 40° is reached. The seeding of spring oats usually begins when the normal daily temperature rises to 43°, corresponding to the advent of the vegetative period. Early potato planting begins as a rule when the normal daily temperature rises to 45° and corn when 55° is reached. The dates on which the latter is reached correspond closely to the average dates of last killing frost in spring. Cotton planting usually does not begin until the normal daily temperature rises to about 62°. The dates on which this temperature is reached correspond closely to the latest dates in spring on which killing frost has occurred.

Cotton and corn are warm-weather crops, and the areas in which successful production on a commercial scale can be accomplished are limited principally by both the general temperature conditions and the temperature at which planting may be accomplished. Owing to the relatively large thermal requirements of corn and cotton, a comparatively warm spring is necessary for best results of germination and early growth.

Mr. Kincer's paper is illustrated by means of several charts showing the average dates on which the critical temperatures required for planting the various crops occur and by diagrams showing the accumulated temperatures for various sections and months.

In connection with this same subject, reference may here be made to a recent study by O. E. Baker, C. F. Brooks, and R. G. Hainsworth ("A Graphic Summary of Seasonal Work on Farm Crops," *U. S. Dept. of Agric. Yearbook for 1917*, pp. 537-589; abstracted in *Monthly Weather Rev.*, Vol. 47, 1919, pp. 323-327). Maps are given which show the dates when planting, harvesting, and other operations are performed in the culture of the staple crops in different parts of the United States. The seasonal distribution of labor by ten-day periods on typical farms in several important agricultural regions is shown by graphs. Information is also given as to the hours of labor per acre required in growing the staple crops in various sections of the country. R. DeC. Ward

Recent Explorations on the Isthmus of Panama. Though for four centuries the Isthmus of Panama has been the international crossing-place between two oceans, a large part of its territory is still almost unknown. In the March, 1919, number (pp. 309-321) of *Natural History* (formerly the *American Museum Journal*) there appears an account of recent explorations which were undertaken by an American army officer in the region between the city of Colón and the ancient harbor of Nombre de Dios and extending from the coast to the headwaters of the Chagres River system. This district, whose western end is almost within sight from the Canal Zone, is an uninhabited wilderness. Lieutenant Colonel Townsend Whelen, author of the article, says that throughout this district not a trace of human inhabitants was found. There are no roads, no trails, not even navigable streams. A luxuriant tropical forest covers the rough, hilly country. Through this, in some places, particularly on the border of the Canal Zone, where a dense second growth has occupied the land once cleared, passage had to be cut with machetes. Into such country it was found impracticable to lead the two companies of infantry that were assigned to this task of exploration. Consequently, from a base-camp established near the eastern extremity of Gatun Lake, small parties consisting of four or five in a group went farther into the forests, remaining from a few days to a month's time according to the supply of food that could be carried or could be obtained in the regions explored. As the expedition was chiefly military and merely aimed at a preliminary exploration in preparation for a later thorough survey and mapping of the region, the scientific results obtained were necessarily meager.

Colonel Whelen, however, records some interesting observations regarding the country traversed. He discovered that the Río Grande, generally supposed to be one of the largest rivers along that section of the coast, is a short and very insignificant stream, while the Río Piedras, though it appears on few maps, is in reality one of the largest watercourses on the isthmus. He also believes that some of the mountains seen by him had never before been sighted.

This region, however, was better known in the early colonial days than at present. Roads existed across it in places, some mines were worked, and small settlements were made in what is now an uninhabited district. The old paved road leading from Panama to Nombre de Dios and Porto Bello, long the principal interoceanic route, led across near Mount Sáximo which Colonel Whelen saw. But with the passing of the Spanish galleons and the increasing use of the route around Cape Horn, these roads were abandoned, the settlements deserted, and the tropical forest regained supremacy. About the middle of last century, when surveys were being made for the Panama Railroad, engineers explored a part of this country, and their map (Map of the Isthmus of Panama representing the line of the Panama Rail Road as constructed under the direction of George M. Totten, Chief Engineer, etc., reduced and compiled from the original surveys by Thos. Harrison, Crown Surveyor, 1:96,000, Jamaica, 1857) is still probably the most detailed as well as the most accurate that has been published.

The Rainfall of Panama. H. G. Cornthwaite, Chief Hydrographer in the Panama Canal Zone, discusses the rainfall of Panama in a recent number of the *Monthly Weather Review* (Vol. 47, 1919, pp. 298-302). Most of the rainfall is of convectional origin, of the afternoon thundershower type. There is a dry season of about four months (January to April) and a rainy season of eight months. The rainfall is heaviest along the Atlantic coast and in sections of the upper Chagres drainage basin and diminishes gradually towards the Pacific coast. The heaviest annual rainfall at any station on the isthmus is approximately 170 inches, at Porto Bello, on the Atlantic coast. In the year 1909, 237.28 inches fell there, constituting a ''record'' for any station on the isthmus. A very favorable characteristic is the small annual variability of the rainfall, for this condition ensures a dependable water supply for the operation of the canal.

During the ''dry season'' the rains usually come in light local showers, but heavier general rains occasionally occur along the Atlantic coast in connection with ''northers.'' The hour of heaviest rainfall is, as a rule, from 2 to 3 P. M. Along the Atlantic coast nearly half of the total rainfall comes at night, this being the result of a smaller percentage of afternoon thundershowers and a larger percentage of general nocturnal rains than occur elsewhere on the isthmus. In November and December general rainstorms, often accompanying storms of the ''norther'' type, may occur, occasionally lasting 24 hours or longer and some of them extending over the entire Canal Zone and adjacent territory. One of the largest freshets in the history of the Chagres River occurred on December 2-3, 1906, in a very heavy general rainstorm accompanying a severe ''norther.'' The maximum 24-hour rainfall on the isthmus, so far recorded, is approximately 11 inches. This has been exceeded at several stations in the United States. R. DeC. Ward

EUROPE

Constantinople and the Straits. From the Trojan War to the Gallipoli campaign the straits connecting the Black Sea and the Mediterranean have possessed a unique strategic importance. According to the deductions of Leaf, Homeric Troy was in reality a great commercial center because of its command of the Black Sea route (W. R. Kermack: Notes on the Historical Geography of the Dardanelles, *Scottish Geogr. Mag.*, July, 1919). The narrow straits present difficulties to sailing vessels. A strong current sets from the Black Sea to the Mediterranean—a circumstance, it might incidentally be noted, that, through the agency of floating mines, proved a valuable help to Turkish defence in the late war. The channel is narrow and winding and during the winter is apt to be swept for days together by the dreaded Etesian wind. With tide and wind against them, sailing ships would be held up at the entrance to the straits, where furthermore Troy controlled the only sources of fresh water supply. The Trojan War is thus resolved into an early struggle for freedom of navigation.

With the fall of Troy trade between the Greek cities and the Black Sea entered on a prosperous epoch. The site of Troy, however, was not possessed of other advantages. The situation at the northern end of the straits is intrinsically far superior. Here is the great crossing point of the north-to-south seaway with the land road running from the Danube via the Maritza valley to Adrianople, crossing the Bosporus and proceeding by the Sakaria valley to the heart of Anatolia—the route of the Berlin-Bagdad railroad. Constantinople commands this crossing point. As soon as Trajan and his successors brought civilization to the Balkans and the Danube, Constantinople arose to capital importance.

Constantinople is exceptionally favored not only as regards situation but also as regards site. The ''incomparable'' natural port is as adequate to the enormous ships of today as to the modest vessels of Phoenicia and ancient Greece. From the entrance to the Bosporus the harmonious curve of the Golden Horn swings northwest for four miles, embracing a deep-water area with good anchorage (Paul Masson: Constantinople et les détroits, *Ann. de Géogr.*, March 15, 1919).

Under Byzantine rule Constantinople figured as the chief trading center of the world, a Paris and a London in one. Under Turkish rule, and especially in the last century, the city has declined in relative importance. Today the commercial movement of the port is exceeded even in the Mediterranean by Marseilles, Naples, Algiers, and Genoa. In part decline is due to miserable economic conditions in the Turkish Empire; among other things Constantinople is entirely lacking in modern port works and facilities. In part decline is due to a loss of the centralized control over roads and markets. The later eighteenth century saw the opening of freedom of navigation to the Black Sea. Constantinople also lost as a center of affairs. Improvement of communications in Anatolia, for instance, led to direct trade with local centers instead of through the great entrepôt.

Of the exact position of Constantinople as a port it is somewhat difficult to form an estimate; statistics are incomplete and otherwise inadequate. There has been a tendency toward gross exaggeration of the port movement through inclusion in statistics of ships passing in transit through the Bosporus. While the trade of Constantinople has relatively declined, that of the straits has been greatly augmented. In character this is distinctly different from that of the great port. Constantinople is a passenger port, a port for merchandise de luxe and the parcel post. The city, which lives in part on its momentum from the past, supports a large population—1,200,000—and perforce has a large import trade. Six-sevenths of the total trade is thus accounted for. Smyrna exceeds Constantinople in the value of exports. Freighters, especially, constitute the movement through the straits. A great proportion of the vessels are British, carrying coal outward and returning with grain from the Black Sea ports. At Constantinople, excluding the large coastal trade, France leads with a service of several regular liners.

Whatever the future, Constantinople must retain the nodal value of its situation, but there are indications of certain changes in the relative strengths of the converging movements. As an outlet for the Balkans it seems that the activity of the city must be more and more restrained. With railroad development there is also the rise of national ports. Kavala and Saloniki take their places besides Constantza, Burgas, and Varna. On the contrary there must be a gain on the Asiatic side as the agricultural and mineral wealth of Anatolia is made available. Constantinople will recover with interest the trade lost in the seventeenth century through the decline of the caravan routes. West and north are the great cereal lands of Bulgaria, Rumania, the Ukraine, of a productivity now comparatively low and now supporting a comparatively small population. Still more is the economic future before the lands farther east. The north-to-south commercial movement through the straits must be enormously increased, and it is especially on this movement that Constantinople must rely for the rebuilding of her ancient prosperity.

The Rainfall of the British Isles in 1918. According to a preliminary report on the rainfall of the British Isles in 1918 issued by the British Rainfall Organization (*London Times,* January 20, 1919, and *Symons's Meteorol. Mag.*, Jan., 1919, pp. 131-132) the past year was marked by an unusual amount of rain in each of the five major divisions of the islands. Wales showed an excess of 13 per cent above the average, Ireland 11 per cent, North England 10 per cent, Scotland 6 per cent, and South England 5 per cent. The excess for the United Kingdom as a whole was 9 per cent. This is a decided contrast to the rainfall of the preceding year, which showed 3 per cent less than the average. In fact, Dr. H. R. Mill, the director of the organization, had already called attention to the series of alternating fat and lean years that has been running since 1910 and had forecast as probable a heavier precipitation for 1918.

If the islands are divided into regions on the basis of their average precipitation, instead of along political boundaries or according to latitude, we find that the usually dry region of eastern Scotland and east-central England enjoyed no greater moisture, but rather suffered, during 1918, a decided deficiency, amounting in some cases to 18 per cent. On the other hand, the great excess of the year was in the wet regions of the west, where it reached as much as 20 and even 30 per cent along the coast of Wales, Ireland, and Scotland. Thus the wet districts were wetter and the dry districts drier than in normal years.

Comparing the data and maps for 1917 with those of last year (see Hugh Robert Mill and Carle Salter: On the Distribution of Rain in Space and Time over the British Isles During the Year 1917, London, 1918; reviewed in *Geogr. Rev.*, Vol. 7, 1919, pp. 354-355) we find that, in general, the same condition held true, viz. the drier sections showed a deficiency and the wetter sections an excess, though over the islands as a whole the year ranked as a dry one, there being only 97 per cent of the usual rainfall. This would seem to indicate an intensifying of the control or controls responsible for the regional difference in precipitation, or, perhaps, a diminution of the forces which tend to interfere with those controls. Though no record of wind directions for the year is as yet available, the distribution above noted would appear to indicate an unusual prevalence or effectiveness of the rain-bearing southwesterlies. These rains water the western shores and the highlands but bring little precipitation to the eastern sections. The latter, depending for their rain upon easterly and northeasterly winds during the interruption of the southwesterlies, fare badly when this interruption does not take place.

A notable feature of the year's rainfall was the unusually wet September, when over most of the United Kingdom there was an excess of more than 100 per cent. This was especially marked in the southern part of England. At London it was the wettest September in the long record of 61 years, 25 days during the month being marked as rainy. This month does not stand alone, however, for during the year seven months show more rainy days than the average year and six months had heavier rainfall than is usual. There was a total of 195 rainy days in London, the average being 163.

PHYSICAL GEOGRAPHY

Does the Moon Cause a Tide in the Air? Dr. S. Chapman has supplemented the earlier work of Laplace and Airy on the lunar atmospheric tide by analyzing the observations made at Batavia and Hongkong together with the records of Greenwich in order to determine the influence of latitude (S. Chapman: The Lunar Atmospheric Tide at Greenwich, 1854-1917, *Quart. Journ. Royal Meteorol. Soc.*, Oct., 1918; idem: The Lunar Tide in the Atmosphere, *Nature*, May 8, 1919). These observations were derived from the registers of a barometer whose readings are taken to 0.001 inch of barometric pressure; and the scale of the photographic register multiplies this by four. The analysis was facilitated by the use of "quiet" days so as to eliminate, as far as possible, the irregular pressure changes, due to various causes, that are characteristic of the atmosphere especially in high latitudes. The extent of the computation was very great, but the results fully justify the necessary expenditure of time and funds.

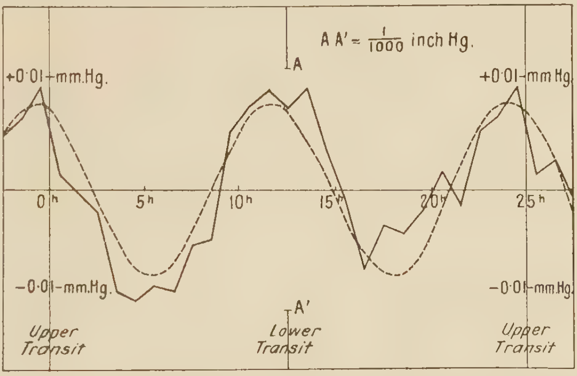

FIG. 1—The lunar semi-diurnal tide in the atmosphere at Greenwich, as determined from the Greenwich records of barometric pressure, 1854-1917. (Copied from a figure in the articles cited in the text.)

The inner two vertical lines mark out a complete lunar day, on either side of which a small portion of the curve is repeated.

The work demonstrated a lunar tide appreciably less than one-thousandth of an inch (AA′ in Fig. 1). The unbroken line of the figure shows the mean lunar hourly inequality of pressure; the broken line is its semidiurnal component. "The accordance between the two graphs shows in a striking manner how effectively this extremely small lunar tidal variation in the atmosphere has been disentangled from the solar and irregular fluctuations of barometric pressure."

GEOGRAPHICAL NEWS

French Geographical Appointments in Alsace-Lorraine. In connection with the reorganization of the administration of Alsace-Lorraine incident on the reversion of the two ''lost provinces'' to France, several scientific appointments of geographical interest are announced. M. Emmanuel de Margerie, the well-known geographer and geologist, has been appointed Director of the Geological Survey of Alsace-Lorraine. Geography will be represented by two chairs at the University of Strasbourg, one occupied by Professor Henri Baulig, recently of the University of Rennes, the other by Pierre Denis, the well-known specialist on South American geography.

PERSONAL

MR. VERNON BAILEY of the U. S. Biological Survey addressed the Biological Society of Washington on May 3 on ''The Explorations of Maximilian, Prince of Wied, on the Upper Missouri in 1833.'' Dr. Bailey described the travels of this early naturalist and discussed his zoögeographical observations.

PROFESSOR HOWARD E. SIMPSON, associate professor of geology and physiography at the University of North Dakota, has been promoted to a professorship of geographic geology at the same institution. Professor Simpson was a member of the American Geographical Society's Transcontinental Excursion of 1912.

PROFESSOR J. RUSSELL SMITH, lately of the University of Pennsylvania, has been appointed Professor of Economic Geography at Columbia University. Professor Smith will give courses in the College, the School of Business, and the Graduate School. His courses will deal with general economic geography, the economic geography of Europe, Latin America, Asia, and Africa and Australia, and with the influence of geographical environment on human affairs.

DR. T. WAYLAND VAUGHAN of the U. S. Geological Survey returned to Washington in the late summer after spending several months in a geologic reconnaissance of the Dominican Republic for the Dominican Government. Dr. Vaughan also visited Port-au-Prince, Haiti, and made arrangements with the Haitian Government for a preliminary geological survey of Haiti.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

UNITED STATES

South Atlantic States

CLARK, W. B. **The geography of Maryland.** Maps, diagrs., ills. *Maryland Geol. Survey* [*Gen. Repts.*], Vol. 10, 1918, pp. 41-167. Johns Hopkins Press, Baltimore, 1918.

After an introduction (25 pp.) this work treats in order the geology of the state (5 pp.), the physiography (29 pp.), the climate (3 pp.), the flora and fauna (1 p.), the natural resources (35 pp.), the manufactures (3½ pp.), and the cities and towns (6 pp.). Following these topics are suggestions for physiographic and geologic excursions (10 pp.) and tables of statistics (10 pp.).

The comments of two reviewers are given below.

Dr. Clark's appreciative attitude in this report is shown by the following statement, with which his treatment of the various physiographic provinces is entirely consistent: "The physical features of a country in no inconsiderable degree determine the pursuits of its inhabitants, and these indirectly affect their social, political, and financial welfare. It becomes necessary, therefore, to know something of the physical features of a state if one would understand its past history or indicate the lines of its future prosperity."

The introduction covers about a fifth of the text and includes a wide variety of topics, some of them, such as education, revenue, and taxation, being only remotely geographic in character. Formal geology is very briefly treated and includes little more than a table of the formations which occur in Maryland. However, there is considerable geological description in the treatment of physiographic features. Much emphasis is rightly placed on the physiographic provinces, which are so well represented in Maryland. Each description of a province includes not only the physiography and its origin but also a discussion of the human relations.

To the eastward lies the Coastal Plain province, which includes the low, flat areas of the "Eastern Shore" and the rolling areas of the "Western Shore." The sinking of the coast has produced Chesapeake Bay, with its drowned estuaries which permit boats to penetrate far into the interior and promote both interstate and intrastate commerce. The shallow waters of the bay and its tributaries also furnish the oysters which make the state famous. The Piedmont Plateau to the westward is divided into the eastward and the westward portions by Parr's Ridge, a divide between the drainage of the Chesapeake and the Potomac. The productive soils were early utilized for farms, and the roads led across the uplands rather than along the valleys. The Blue Ridge, Greater Appalachian Valley, Alleghany Ridges and Valleys, and the Alleghany Plateau are briefly described. A very useful topic is the suggestions for physiographic and geologic excursions in different parts of the state.

The style is simple and readable, and the report is entirely free from the "boosting" features which are far from uncommon in many similar state reports. Excellent maps and sections are liberally used, and the illustrations really illustrate the text. The discussion of peneplanation in the Piedmont and Appalachian regions is not likely to be clear to the lay reader. Dr. Clark wrote with such fullness of knowledge that he probably overestimated his readers' ability to follow him. In the reviewer's judgment, the treatment of climate is too brief; for surely climate is one of the great geographic factors affecting mankind. The report is welcome as showing the appreciation of geography by a leading earth scientist; it should also encourage other state surveys and organizations to put sane, readable geographic information before their readers.

F. V. EMERSON

This is a posthumous work of Dr. William Bullock Clark, who for years previous to his death in July, 1917, had been professor of geology in Johns Hopkins University, state geologist, director of the Maryland Weather Service, state forestry commissioner, state roads commissioner, etc., and had therefore had exceptional opportunities for knowing his adopted state thoroughly. Much if not most of the material in the book, including illustrations, had appeared previously in other works by the author and various associates, particularly a pamphlet on the natural resources of Maryland prepared for the Chicago World's Fair, a report on the physical features of the state which occupied a large part of the first volume of *Maryland Geological Survey General Reports* (1897) and was revised and elaborated in the sixth volume of the same series (1907), a report on the physiography of Maryland by Cleveland Abbe, Jr., in the first volume of the Maryland Weather Service reports (1899), the "Plant Life of Maryland" by Forrest Shreve and others, which constituted the third volume of the series last named (1910), and several voluminous county monographs of the Maryland Geological Survey. Typographically it is of the same high class as other official scientific publications of Maryland.

The topic of flora is very briefly treated, probably because regarded as having been sufficiently covered by the "Plant Life of Maryland"; but there seems to be no satisfactory treatment of the fauna of the state in any official publication, and it is indeed a rather difficult matter for a geographer to handle.

Regional geography is treated under physiography. The state is divided into three main divisions, coastal plain, Piedmont, and Appalachian, each with two or three subdivisions. The regional treatment of the coastal plain seems very inadequate to one familiar with the great diversity of that province. It is divided in this work, as in a few previous publications of the Maryland Geological Survey, into a few supposed Pleistocene terraces (first distinguished by G. B. Shattuck in 1901), which are hard for the uninitiated (including the reviewer, who has been in every county in Maryland and specialized on the coastal plain) to recognize and are chiefly of academic interest anyway, for they are not shown in this work or elsewhere to bear any constant relation to soils, vegetation, population, or agriculture. In reality the features just named correlate much better with a map of the Cretaceous and Tertiary formations, which is very different from a terrace map, and it is strange that this relation has not been more clearly perceived by geologists. Even the striking differences in shore lines made by the different geological formations on the Bay side of the Eastern Shore, which are very obvious on a good geological map, receive no mention.

The several regions are not contrasted statistically, even in such simple matters as density and color of population, but this may be partly because the counties are so large that most of them cover parts of two or more regions. The book contains no maps other than small text figures occupying about a third of a page each; but a large colored geological map of the state published in 1906-07 (one edition of which shows the supposed terraces of the coastal plain) is distributed separately by the Survey and should be used in connection with this work.

In the chapter on agriculture are seven maps showing the value of farm buildings and production of certain crops per county (which means little, for the counties of course are not all the same size), by means of shading in several—usually seven—grades. The period to which these statistics pertain is not indicated, but it is presumably that of the Twelfth Census (1899-1900), for the same maps appeared in F. H. Blodgett's chapter on agriculture in the "Plant Life of Maryland" in 1910. They are very poorly visualized, for while the lowest grade is left blank in every case, the two next lowest, on every map but one, have the densest ruling.

This handsome state geography will doubtless be appreciated by Maryland teachers and, together with its predecessors, will furnish an excellent foundation for future systematic work on the geography of this very accessible and diversified state.

ROLAND M. HARPER

BOWMAN, H. H. M. **Botanical ecology of the Dry Tortugas.** Diagrs., ills. *Papers from the Dept. of Marine Biology of the Carnegie Inst.*, Vol. 12, pp. 111-138. Washington, D. C., 1918.

CARY, L. R. **The Gorgonaceæ as a factor in the formation of coral reefs.** Map, ills. *Papers from the Dept. of Marine Biology of the Carnegie Inst.*, Vol. 9, pp. 343-362. Washington, D. C., 1918. [Deals with the Florida-Antillean region.]

DOLE, R. B., AND A. A. CHAMBERS. **Salinity of ocean-water at Fowey Rocks, Florida.** Diagrs. *Papers from the Dept. of Marine Biology of the Carnegie Inst.*, Vol. 9, pp. 299-315. Washington, D. C., 1918.

HARPER, R. M. **A phytogeographical sketch of southern Maryland.** *Journ. Washington* [*D. C.*] *Acad. of Sci.*, Vol. 8, 1918, No. 18, pp. 581-589.

HARPER, R. M. **High living standards in "black" counties (in the southeastern United States).** 2 pp. University, [Ala.,] 1919. ["Slightly abridged from a letter published in *The Montgomery Advertiser* . . . . March 28, 1919."]

HEYE, G. G., F. W. HODGE, AND G. H. PEPPER. **The Nacoochee mound in Georgia.** 103 pp.; diagrs., ills. *Contribs. Museum of the Amer. Indian, Heye Foundation,* Vol. 4, 1918, No. 3. New York.

HULL, J. P. D., LAURENCE LA FORGE, AND W. R. CRANE. **Report on the manganese deposits of Georgia. (Second report on manganese).** Foreward by S. W. McCallie. xiv and 295 pp.; maps, diagrs., ills., index. *Geol. Survey of Georgia Bull. No. 35.* Atlanta, 1919.

SCHWAB, W. G. **The forests of Dickenson County, Virginia.** 17 pp.; map, ills. *Virginia Geol. Commission Bull. No. 17.* Charlottesville, 1917.

SCHWAB, W. G. **The forests of Tazewell County, Virginia.** 14 pp.; map, ills. *Virginia Geol. Commission Bull. No. 18.* Charlottesville, 1917.

SELLARDS, E. H. **Florida State Geological Survey: Tenth and eleventh annual reports.** 130 pp.; maps, ills., index. Tallahassee, 1918.

SHEARER, H. K. **Report on the slate deposits of Georgia.** x and 192 pp.; maps, diagrs., ills., index. *Geol. Survey of Georgia Bull. No. 34.* Atlanta, Ga., 1918.

SWICK, C. H. **Triangulation in Georgia.** 59 pp.; maps, index. *U. S. Coast and Geodetic Survey Serial No. 65.* Washington, D. C., 1917.

VAUGHAN, T. W. **The temperature of the Florida coral-reef tract.** Maps. *Papers from the Dept. of Marine Biology of the Carnegie Inst.,* Vol. 9, pp. 321-339. Washington, D. C., 1918.

WATSON, T. L. **The Virginia earthquake of April 9, 1918.** Map. *Bull. Seismol. Soc. of Amer.,* Vol. 8, 1918, No. 4, pp. 105-116. Stanford University, Cal. [Evidence available from reports, seismograph records, and a consideration of the geological structure of the district affected indicates that this earth tremor had its origin in one or more of the faults known to exist in the parallel ridges that bound the Shenandoah Valley.]

[***Topographic map of the United States.***] Sheets, 1: 62,500: (1) ***Cape Henlopen,*** (2) ***Cedar Creek,*** (3) ***Rehoboth, Del.;*** (4) ***Harrington, Del.-Md.;*** (5) ***Cambon,*** (6) ***Jacksonville,*** (7) ***Mayport,*** (8) ***Middleburg,*** (9) ***Orange Park,*** (10) ***Palm Valley, Fla.;*** (11) ***Cumberland,*** (12) ***Everett City,*** (13) ***Hinesville,*** (14) ***Hortense,*** (15) ***Jesup,*** (16) ***Nahunta, Ga.;*** (17) ***Folkston,*** (18) ***Kingsland,*** (19) ***Moniac, Ga.-Fla.;*** (20) ***Walterboro, S. C.;*** (21) ***Aylett,*** (22) ***Carterton,*** (23) ***Charles City,*** (24) ***Doswell,*** (25) ***Morattico, Va.;*** (26) ***Richmond, W. Va.*** U. S. Geol. Survey, Washington, D. C., 1918.

Western States

—— **Anza, Colonel Juan Bautista de, Governor of New Mexico: Diary of his expedition to the Moquis in 1780.** With an introduction and notes by Ralph E. Twitchell. 47 pp.; ills. *Hist. Soc. of New Mexico* [*Publ.*] *No. 21.* Santa Fe(?) [Paper read at the annual meeting, 1918.]

ATWOOD, W. W. **Relation of landslides and glacial deposits to reservoir sites in the San Juan Mountains, Colorado.** 38 pp.; maps, diagrs., ills. *U. S. Geol. Survey Bull. 685.* Washington, D. C., 1918.

DANA, S. T. **What the National Forests mean to the water user.** 52 pp.; map, ills. U. S. Dept. of Agriculture, Forest Service, Washington, D. C., 1919. [A popular discussion of the value of national forests.]

GRAVES, H. S. **Thunder Mountain.** Ills. *Amer. Forestry,* No. 303, Vol. 25, 1919, March, pp. 907-911. Washington, D. C. [This important watershed in central Idaho, from which many streams flow into the upper tributaries of the Columbia River, has not yet been included within the National Forests by which it is surrounded. The Chief Forester urges the necessity of its being so included, both as a safeguard against the spread of fire into the adjoining timber and as a protection to the water supply of the Columbia.]

HALLENBECK, CLEVE. **Night-temperature studies in the Roswell fruit district.** Map, diagrs. *Monthly Weather Rev.,* Vol. 46, 1918, No. 8, pp. 364-373. Washington, D. C. [This district, covering an area of 1,200 square miles, mostly west of the Pecos

River, New Mexico, includes practically all of the fruit-growing and farming lands of the valley.]

Knopf, Adolph. **A geologic reconnaissance of the Inyo Range and the eastern slope of the southern Sierra Nevada, California.** With a section on the stratigraphy of the Inyo Range, by Edwin Kirk. 130 pp.; maps, diagrs., ills., bibliogr., index. *U. S. Geol. Survey Professional Paper 110.* Washington, D. C., 1918. [This paper describes the region containing the recently developed wolfram deposits of the Tungsten Hills.]

Varney, B. M. **Thirty-year synopsis: Meteorological observations made at Berkeley from July 1, 1887, to June 30, 1917.** Diagrs. *Univ. of California Publs. in Geogr.,* Vol. 2, 1919, No. 1, pp. 1-18. Berkeley.

Mexico and Central America

Pani, A. J. **Hygiene in Mexico [City]: A study of sanitary and educational problems.** Transl. by E. L. de Gogorza. xii and 206 pp.; diagrs. G. P. Putnam's Sons, New York and London, 1917. $1.50. 7½ x 5.

Mexico City is the most unhealthful large city in the world, in spite of the fact that its situation at an elevation of 7,000 feet gives it advantages over other tropical cities situated near sea level. The author of this work points out some of the causes of the high death rate. Modern man is not entirely responsible. A large share of the guilt rests upon Cortés, who, contrary to explicit instructions from the Spanish crown as to the sanitary conditions necessary for the site of New Spain's capital, determined to build upon the ruins of Tenochtitlan. In the opinion of Señor Pani a worse location could scarcely have been found. Situation, topography, the character of the soil, temperature, humidity of the atmosphere, rains, and winds, all contribute toward its unhealthfulness. The depression occupied by Lake Texcoco, around which the city is built, was the lowest part of the enclosed upland basin and hence received and retained the entire drainage of the city and the surrounding region. This condition was partly remedied by the completion in 1900 of the famous *desague,* or drainage canal, one of the greatest engineering enterprises ever undertaken. As the city grew out over the swampy borders of the lake, a water-soaked subsoil kept the surface far too damp for healthful conditions. Moreover, great daily range of temperature, marked difference between the shade and the sun, and sudden abrupt changes combine with high atmospheric humidity during the summer months to make distempers of the digestive system very common. Added to this, the prevailing northerly winds come from valleys destitute of vegetation and bring clouds of dust. Diseases of the respiratory organs cause an average of 4,329 deaths a year in this city of 471,000 people.

According to the author the case is grievously aggravated by the entire lack of sanitary precautions among all classes of the people, who have not yet taken to heart the new doctrine that "filth is a sin." The dwellings lack sanitary provisions. Halls, vestibules, etc., which would serve to avoid sudden changes of temperature in passing from room to room are uncommon in the Mexican style of building about an open *patio.* Window space, too, is sadly lacking. The streets, laid out in north-south and east-west directions, afford poor distribution of sunlight, while they are almost invariably so narrow as greatly to limit the hours of exposure to the sun's rays.

Though many of these natural disadvantages cannot be remedied, the author urges the organization of a far more effective sanitary service. He believes, too, that general education of the people and better economic conditions for the poorer classes will make possible a greater degree of hygiene that will offset some of the defects in location and construction of the city.

Bustamante, Miguel. **El petróleo en la República Mexicana: Estudio geológico económico sobre los yacimientos petrolíferos Mexicanos.** Part I. iv and 216 pp.; maps, diagrs., ills. *Inst. Geol. de Mexico Bol. No. 35.* Mexico, 1918.

López, Elpidio. **Régimen pluviométrico de la República Mexicana.** *Bol. Soc. Mexicana de Geogr. y Estadística,* Vol. 7, 1918, No. 8, pp. 425-429. Mexico.

López-Portillo y Rojas, José. **Los Chimalhuacanos.** Ills. *Bol. Soc. Mexicana de Geogr. y Estadística,* Vol. 8, 1918, No. 1, pp. 42-67. Mexico.

Powers, Sidney. **Notes on the geology of eastern Guatemala and northwestern Spanish Honduras.** Maps. *Journ. of Geol.,* Vol. 26, 1918, No. 6, pp. 507-523.

Rouaix, Pastor. **Descripción de una parte de la Sierra Madre en el Estado de Durango desde los limites de Chihuahua hasta el paralelo 24.** *Bol. Soc. Mexicana de Geogr. y Estadística,* Vol. 7, 1918, No. 9, pp. 551-565. Mexico.

Salinas, Miguel. **El río de Yautepec.** *Bol. Soc. Mexicana de Geogr. y Estadística,* Vol. 7, 1918, No. 8, pp. 385-389. Mexico.

Talbot, E. H. **Present conditions and the outlook in Mexico.** *Journ. of Race Devel.,* Vol. 9, 1919, No. 4, pp. 344-361. Worcester, Mass.

Ugalde, José. **Las inundaciones en el Estado de Tabasco.** *Bol. Soc. Mexicana de Geogr. y Estadística,* Vol. 7, 1918, No. 8, pp. 391-396. Mexico.

SOUTH AMERICA

Paraguay, Uruguay, Argentina, Chile

Ojeda, L. T. **Formación de la raza chilena.** *Rev. Chilena de Hist. y Geogr.,* Vol. 26, 1918, No. 2, pp. 76-89. Santiago de Chile.

Ojeda, T. T. **Cuestiones de geografía austral de Chile: I, El istmo de Ofqui; II, Limites de Llanquihue, Chiloé, y territorio de Magallanes.** *Rev. Chilena de Hist. y Geogr.,* Vol. 25, 1918, No. 1, pp. 161-217. Santiago de Chile. [An account of explorations in the south of Chile and the interprovincial boundaries in that region.]

Ormezzano, Vincenzo. **Le comunicazioni fra l'Italia e il Cile.** *La Geografia,* Vol. 5, 1917, No. 2, pp. 63-68. Novara.

Outes, F. F. **Nuevos rastros de la cultura Guaraní en la cuenca del Paraná inferior.** Ills. *Anal. Soc. Científica Argentina,* Vol. 85, 1918, No. 3-4, pp. 153-182. Buenos Aires.

—— **Paraguay: General descriptive data.** 31 pp.; ills. Pan American Union, Washington, D. C., 1916.

Pardo, Denis. **Territoire National de los Andes, Puna de Atacama.** *Atti X Congr. Internaz. di Geogr., Roma, 1913,* pp. 1245-1298. Reale Società Geografica, Rome, 1915. [A useful study of a region on which geographical literature is scanty. From the economic standpoint the region is, or rather will become, important on account of its mineral wealth—borate, sulphur, silver, and copper.]

Rassmuss, Juan. **Investigación de la extructura tectónica de la cuenca imbrífera del Río de la Rioja con motivo de la diminución del caudal de dicho río.** 20 pp.; diagrs., ills. *Direcc. Gen. de Minas, Geol. e Hidrol. Bol. No. 17, Ser. B* (*Geol.*). Minist. de Agric., Buenos Aires, 1918.

Romero, A. A. **El homo pampaeus: Contribución al estudio del origen y antigüedad de la raza humana en Sud América según recientes descubrimientos.** Ills. *Anal. Soc. Científica Argentina,* Vol. 86, 1918, No. 1-2, pp. 5-48. Buenos Aires.

—— **Santiago, Observaciones meteorológicas en 1911-1915, (resúmenes).** Introduction by Cárlos Henriquez. 50 pp.; diagrs. *Inst. Meteorol. y Geofísico de Chile Sección Meteorol.* [*Publ.*] *No. 21.* Santiago de Chile, 1917.

Sobral, J. M. **Estudio petrográfico de algunas rocas argentinas.** 54 pp.; ills. *Anal. Minist. de Agric.: Sección Geol., Mineral. y Mineria,* Vol. 13, No. 2. Direcc. Gen. de Minas, Geol. e Hidrol., Buenos Aires, 1918.

Uhle, Max. **Fundamentos étnicos de la región de Arica y Tacna.** Ills. *Bol. Soc. Ecuatoriana de Estudios Hist. Amer.,* Vol. 2, 1919, No. 4, pp. 1-37. Quito.

Uhle, Max. **Los aborígenes de Arica y el hombre americano.** *Rev. Chilena de Hist. y Geogr.,* Vol. 27, 1918, No. 3, pp. 33-54. Santiago de Chile.

—— **Uruguay: General descriptive data.** 31 pp.; ills. Pan American Union, Washington, D. C., 1916.

Wagemann, Ernst. **Die Wirtschaftsverfassung der Republik Chile.** viii and 253 pp.; bibliogr. Duncker & Humblot, Munich and Leipzig, 1913. M. 6. 10 x 7.

Wichmann, Ricardo. **Geología e hidrogeología de Bahía Blanca y sus alrededores (Provincia de Buenos Aires).** 67 pp.; map, ills. *Anal. Minist. de Agric.: Sección Geol., Mineral. y Mineria,* Vol. 13, No. 1. Direcc. Gen. de Minas, Geol. e Hidrol., Buenos Aires, 1918.

Windhausen, A. **The problem of the Cretaceous-Tertiary boundary in South America and the stratigraphic position of the San Jorge-formation in Patagonia.** Maps, diagr. *Amer. Journ. of Sci.,* No. 265, Vol. 45, 1918, pp. 1-53.

—— ***Argentina, Mapa geológico-económico de la República. Hoja 35 m*** (***Bahía-Blanca***). 1:200,000. [In three sheets:] (1) ***Geologia;*** (2) ***Topografia*** [relief in contours; intervals seemingly 6¼ meters]; (3) ***Datos complementarios*** [containing data on water supply and soils]. Minist. de Agric., Direcc. Gen. de Minas, Geol. e Hidrol., Buenos Aires, 1916.

Ludwig, Pablo. ***Nuevo Mapa de la República Argentina y sus paises limítrofes Chile, Uruguay, y Paraguay.*** 1:4,000,000. Pablo Ludwig, Buenos Aires, 1916. [Good reference map. Relief in brown shading. Provinces, etc., prominently colored.]

EUROPE

General

—— **Baltic Provinces and Lithuania, The peoples of the.** Map. *The Round Table,* No. 30, March, 1918, pp. 293-307. London.

Beret, Georges. **Autour d'une mer: La question de l'Adriatique.** *Colonies et Marine,* Vol. 3, 1919, No. 1, pp. 19-32. Paris.

Cole, G. A. J. **The narrow seas and the Arctic route to Muscovy.** *Geogr. Teacher,* No. 53, Vol. 10, Part I, 1919, pp. 4-8. London.

Demorlaine, J. **Strategic importance of forests in the war.** Translated by S. T. Dana from *Rev. des Eaux et Forêts,* February, 1919, and revised to date by P. S. Ridsdale. Ills. *Amer. Forestry,* No. 305, Vol. 25, 1919, May, pp. 1040-1043. Washington, D. C.

Hannay, H. B. **European and other race origins.** xxxv and 491 pp.; maps, bibliogr., index. Sampson Low, Marston & Co., Ltd., London, 1915(?) 9 x 6.

Lingelbach, W. E. **Geographic factors in the world war.** *Bull. Geogr. Soc. of Philadelphia,* Vol. 16, 1918, No. 4, pp. 126-139.

Louis, H. **Mineral production in relation to the peace treaty.** *Nature,* No. 2585, Vol. 103, 1919, May 15, pp. 205-206. London.

Meillet, A. **Les langues dans le bassin de la mer Baltique.** *Scientia,* Vol. 24, 1918, pp. 383-392. Bologna.

Nitsch, Casimir. **Frontières linguistiques polono-tchèque et polono-slovaque.** *Le Moniteur Polonais,* No. 18, 1919, February 15, pp. 374-379. Bern.

Roncagli, Giovanni. **Physical and strategic geography of the Adriatic.** Maps, ills. *Geogr. Journ.,* Vol. 53, 1919, No. 4, pp. 209-228 (discussion, pp. 223-228).

Rubicon [pseud.]. **Czecho-Slovak claims.** Maps. *The New Europe,* No. 128, Vol. 10, 1919, March 27, pp. 247-251; No. 129, April 3, pp. 275-280; No. 130, April 10, pp. 304-309. London.

—— **Ruthénie-Blanche, Les problèmes politiques en.** Map. *Le Moniteur Polonais,* No. 16, 1919, January 15, pp. 340-346. Bern.

Savič, V. R. **South-Eastern Europe: The main problem of the present world struggle.** Introduction by Nicholas Murray Butler. 276 pp.; map, ill., index. Fleming H. Revell Co., New York, 1918. $1.50. 8½ x 5½.

Winterbotham, H. S. L. **British survey on the western front.** Maps, ill. *Geogr. Journ.,* Vol. 53, 1919, No. 4, pp. 253-276 (discussion, pp. 271-276). [Tells in some detail of the work accomplished by the Allied surveyors in the preparation of large-scale maps made necessary by "a war of positions."]

—— ***Europe, 1:1,000,000.*** Sheets, ***North:*** (1) ***L 30, Bordeaux;*** (2) ***L 37, Rostov;*** (3) ***M 29, Cork;*** (4) ***M 37, Kharkov;*** (5) ***N 37, Moskva*** (***Moscow***); (6) ***O 29, Stornoway;*** (7) ***O 30, Aberdeen;*** (8) ***O 31, Stavanger;*** (9) ***O 32 and part of O 31, Kristiania and part of Stavanger;*** (10) ***O 37, Yaroslavl;*** (11) ***O 38, Nijni Novgorod;*** (12) ***P 29 and 30, Thorshavn and Lerwick;*** (13) ***P 31 and 32, Bergen and Trondhjem;*** (14) ***P 37 and 38, Kargopol and Ustyug;*** (15) ***Q 33 and 34 and part of 32, Bodö and Lulea and part of Namsos;*** (16) ***Q 37 and 38, Arkhangelsk and Mezen;*** (17) ***R 37 and 38, Rinda and Kanin.*** (All except L 30, L 37, M 37, N 37, are provisional editions.) *Geogr. Sect., Genl. Staff* [*Map*] *No. 2758.* Ordnance Survey Office, Southampton, 1917-1918. [Drainage in blue, relief in brown contours, railroads and names in black, roads in red.]

Gross, Alexander. ***The Daily Telegraph map No. 25: Races of Eastern Europe.*** [1:2,000,000.] "Geographia" Ltd., London, 1917(?) [Good general map. Could be used effectively as a wall map because of its large scale and contrasting colors. In the Balkans, the Serbo-Bulgarian ethnic frontier is shown to lie east of the political frontier, and the Macedonian Slavs are, with Cvijić, treated as a separate unit. The separation of Ruthenians and Little Russians, especially by so contrasting colors as those used, is unfortunate. The distinction of the Maltese as a separate ethnic unit seems like overdoing the point.]

Gross, Alexander. ***The Daily Telegraph war map No. 29: "The German Peace."*** [1:2,000,000.] ''Geographia'' Ltd., London, [1918.] [Shows new boundaries as defined by the Treaty of Brest Litovsk, March 3, 1918, and the Treaty of Bucharest, June 12, 1918.]

Gross, Alexander ***The Daily Telegraph gazetteer war map No. 4.*** Compiled from official sources. [1:633,600.] ''Geographia'' Ltd., London, [1918.] [Shows battle line on June 30, 1916, March 21, June 30, and Nov. 11, 1918; also armistice frontier and neutral zone.]

—— ***Western Front, The Allies' map of the: A detailed reference map, Paris to the Rhine.*** 1:475,000 (7½ miles to 1 inch). George Philip & Son, Ltd., [1918.] [Good map, general and yet sufficiently detailed, to follow the military campaigns on the western front. The following battle lines are shown in red: (1) extreme limit of German advance, Sept. 5, 1914; (2) battle front of July 1, 1916; (3) battle front of March 20, 1918; (4) limit of German advance to July 18, 1918; (5) limit of Allies' advance to Oct. 23, 1918.]

Russia

Funck-Misoutch, M. R. **Le ricchezze minerali della Russia.** *La Geografia,* Vol. 6, 1918, No. 2, pp. 82-88. Novara.

LeVasseur, N. **Choses de Russie.** *Bull. Soc. de Géogr. de Québec,* Vol. 12, 1918, No. 4, pp. 217-221.

Marchant, F. P. **The Cecho-Slovaks in Russia and the British Declaration.** *Asiatic Rev.,* No. 40, Vol. 14, N. S., 1918, Oct., pp. 437-448. London.

Winter, N. O. **The Ukraine, past and present.** Ills. *Natl. Geogr. Mag.,* Vol. 34, 1918, No. 2, pp. 114-128.

—— ***European Russia, Railway map of.*** In 2 sheets. [1:2,500,000.] R. Martens & Co., New York. 1919. [Valuable map based on the official Russian railroad map showing the names of practically all stations. The system of transliteration is not adjusted to English usage throughout; for instance the full ''u'' sound is rendered by the French equivalent ''ou.'']

—— ***Ukraine and the contiguous countries, General physical chart of the.*** [1:5,000.000.] Svoboda, Jersey City, [1918]. [Relief in very fair hachuring in brown and seven altitude tints. Exceptionally good for a wax-engraved map.]

Austria-Hungary*

Dainelli, Giotto. **La popolazione di Fiume.** *Riv. Geogr. Italiana,* Vol. 26, 1919, No. 1-4, pp. 28-46. Florence.

Eredia, Filippo. **Il clima di Gorizia nel quarantacinquennio 1870-1914.** 11 pp. Reprint from *Boll. Bimensuale Soc. Meteorol. Italiana,* 1917, No. 6-9. Turin.

Laeng, Gualtiero. **Il Carso: Geografia, geologia, paesaggio e vegetazione, doline, grotte e abissi, idrologia sotterranea.** Maps, diagrs., ills. *Riv. Mensile Club Alpino Italiano,* Vol. 36, 1917, No. 8-9-10, pp. 190-197; No. 11-12, pp. 233-246. Turin.

Baratta, Mario. ***Carta del grande altopiano della Carsia Giulia*** (***Carso triestino-goriziano***). 1:100,000. [With 24 pp. of text.] Inset: Gli altipiani della Carsia, 1:500,000. Istituto Geografico De Agostini, Novara, 1918. L. 2.50. [Admirable map, showing relief in shading and contours, with the lowlands tinted green. An inset, 1:500,000, shows the plateaus of the Karst, distinguishing between the limestone uplands and the alluvial lowlands.]

ASIA

Turkey in Asia, Arabia, Caucasia, Iran

Bernard, Augustin. **La Syrie et les Syriens.** *Ann. de Géogr.,* No. 151, Vol. 28, 1919, pp. 33-51.

Bertacchi, Cosimo. **L'Armenia.** 24 pp.; map, ills., bibliogr. *Quaderni Geografici,* Vol. 1, 1918, No. 2. Istituto Geografico de Agostini, Novara, 1918.

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* Pending the final settlements, the political divisions of 1914 will be retained.—Edit. Note.

Carruthers, Douglas. **The great desert caravan route, Aleppo to Basra.** Map. *Geogr. Journ.*, Vol. 52, 1918, No. 3, pp. 157-184.

Holdich, Thomas. **Bagdad.** *Journ. Central Asian Soc.*, Vol. 4, 1917, Part II, pp. 40-55 (discussion, pp. 49-55). [London.]

—— **Palestine and Jewish nationalism.** *The Round Table*, No. 30, March, 1918, pp. 308-336. London.

Pears, Edwin. **Turkey, the war, and climatic influences in Asia Minor.** *Journ. Central Asian Soc.*, Vol. 2, 1915, Part III, pp. 97-112 (discussion, pp. 108-112). [London.]

Pichery, P. **La question d'Asie-Mineure.** Map. *Colonies et Marine*, Vol. 3, 1919, No. 4, pp. 241-247. Paris.

Taylor, A. B. **The River Tigris from the sea to Baghdad.** *Journ. Central Asian Soc.*, Vol. 4, 1917, Part III, pp. 72-89 (discussion, pp. 87-89). [London.]

—— **Turkey: A past and a future.** Reprinted (with additions) from *The Round Table*, for June, 1917. 79 pp.; maps. Hodder & Stoughton, London, 1917. 9½ x 6.

—— ***Armenia, The seat of war in.*** (Stanford's War Maps, No. 10.) 1:1,000,000, or 1 inch to 15.78 miles. Edward Stanford, Ltd., London, 1915. [Map on relatively large scale; relief in brown shading.]

China

Caraci, Giuseppe. **Il padre Matteo Ricci e le carte speciali della Cina nelle collezioni di Ortelio e di Mercatore.** *Boll. Reale Soc. Geogr. Italiana*, Vol. 7, 1918, No. 11-12, pp. 845-851. Rome.

Chapman, H. H. **Forests and floods in China.** Ills. *Amer. Forestry*, No. 302, Vol. 25, 1919, February, pp. 835-843. Washington, D. C.

Cheng, Shi-Gung. **China's geography: Historical and social.** Map, ills. *Scottish Geogr. Mag.*, Vol. 34, 1918, No. 8, pp. 281-294.

—— ***China, Postal map of.*** (Enclosure to "Report on the Working of the Chinese Post Office" for the Sixth Year of Chung-Hua Min-Kuo (1917) and 7th issue of The Postal Guide.) 1:2,400,000. Directorate General of Posts, Shanghai, 1917. 50 cents. [Shows postal routes in detail, those established in 1917 being differentiated in red.]

—— ***Kiangsu District, Postal route map of.*** [1:1,400,000.] Corrected to December 31, 1917. [In English and Chinese.] [Postal Commissioner's Office, Nanking, 1918.]

Teichman, Eric. ***China: Map showing routes in the province of Shensi.*** 1:2,000,000. Accompanying the author's article "Notes on a Journey Through Shensi," *Geogr. Journ.*, Vol. 52, 1918, No. 6.

WORLD AS A WHOLE AND LARGER PARTS

Watson, Malcolm. **Rural sanitation in the tropics: Being notes and observations in the Malay Archipelago, Panama, and other lands.** xvi and 320 pp.; maps, diagrs., ills. John Murray, London, 1915. 12s. 9 x 6.

Long experience in the Malay Peninsula, both in government work and in the sanitation of private estates, has given Dr. Watson a thorough knowledge not only of malaria, but of how to prevent it. Wide travel has broadened his perspective so that he views his problem as part of the greater problem of the uplifting of the tropics. Although nearly two-thirds of his book is devoted to details of the familiar story of the preventive measures employed at Panama, the most valuable parts deal with neighboring regions and with Malaya. A short section on British Guiana states that in many districts "the infantile mortality is so high that the negro population is actually decreasing. The high infantile death rate is indeed the negro's chief asset. It keeps wages so high that if he works for a day he can retire to his hut for a week." Barbados receives attention as an example of a tropical region without malaria. Dr. Watson, on apparently good grounds, rejects the usual view that mosquitoes are absent because the larvae are eaten by a small minnow called the "millions." He attributes the island's immunity to its geological structure as a coral reef. He might have strengthened his argument by stating that the Bahamas, which are likewise composed of recently uplifted coral limestone, are almost free from malaria. In both cases the limestone is so porous that there is practically no standing water. Hence no breeding places for mosquitoes.

The most interesting part of Dr. Watson's book is the first one hundred pages where he describes his own experience in British Malaya. Few people realize the wonderful progress that has been made in the prevention of malaria on tropical plantations. Everyone is familiar with what has been achieved in Panama, but that is a highly specialized case where large numbers of people are gathered in a small area, where the government has complete and easy control, and where large amounts of money have been freely spent. On isolated plantations, however, where native labor is being employed to raise rubber, cacao, bananas, and other tropical products, the prospects have appeared by no means so bright. Nevertheless Dr. Watson shows that in Malaya it has been possible almost entirely to eradicate malaria in the level lowlands by the simple expedient of careful ditching and drainage. At first quinine was administered as a preventive, houses were screened, and other methods such as oiling the pools were tried, but it was soon found that drainage alone is sufficient. The only requisites are that the drains extend to a distance of 2,000 feet or so from the dwellings, that they be dug so that the water keeps slowly in motion, and that weeds and materials on which the mosquitoes can breed be carefully cleaned out. Under such conditions even the careless natives enjoy almost complete immunity except when they go out into surrounding districts where malaria still prevails.

Contrary to the general belief the elimination of malaria in many tropical regions is much harder among the hills than in the swamps. The ordinary view of the matter is based on conditions in regions like Italy where the malarial mosquitoes are confined to the lowlands. In southeastern Asia, however, including India, the Malay Peninsula, and some of the neighboring islands several kinds of malarial mosquitoes live in the clear running streams of the mountains. Attempts to get rid of them by cleaning out the streams so that there are no grasses, sticks, or protected places on which the larvae may lodge have proved sadly ineffective. Dr. Watson discovered that this is because even in swiftly running water the larvae of these species can cling to rocks or other hard substances and thus breed in streams of crystal clearness and purity. Among the hills, therefore, he promptly put all the water underground in closed drains. Thus highland plantations have been rendered as safe as those of the lowlands, and death rates reduced to one-tenth of what they were.

Dr. Watson's investigations seem also to indicate that slight changes in the chemical composition of the water are enough to drive away one species of mosquitoes or another. Thus it may be possible to employ still another method in improving the health of the tropics. Furthermore, the author describes many instances where the thorough cultivation of the land has largely eliminated malaria. Where all the land is well tilled there is little room for stagnant water. Thus in one way or another there is hope not only for the towns of tropical regions, but for the plantations, whose cultivation must form the basis of any real progress. By a combination of sound engineering work with brilliant scientific speculation Dr. Watson has put himself among the leaders in the regeneration of the vast regions cursed by malaria. Large parts of his book record his observations with an almost unnecessary degree of minuteness. Nevertheless its many pages of admirable exposition, its descriptions, such as that of fortunate non-malarial Sumatra, and its earnest, open-minded spirit commend it to all who are interested in the lands within thirty degrees of the equator.

ELLSWORTH HUNTINGTON

MATHEMATICAL GEOGRAPHY

CARTOGRAPHY

BREMNER, ALEXANDER. **A new medium for the construction of geographical models.** Diagrs. *Scottish Geogr. Mag.*, Vol. 34, 1918, No. 9, pp. 342-350. [Molders' sand.]

BROWN, ROBERT M. **Making wall maps of limited areas.** Maps. *School Sci. and Math.*, Vol. 18, 1918, No. 5, pp. 397-400. Chicago.

DE MARCHI, LUIGI. **La rappresentazione della superficie terrestre.** *Scientia*, Vol. 25, 1919, pp. 186-195. Bologna. [A discussion of the best projection methods for the various kinds of mapping.]

PHYSICAL GEOGRAPHY

METEOROLOGY AND CLIMATOLOGY

(1) —— **Barometer manual for the use of seamen, A: A text-book of marine meteorology.** 8th edit. 106 pp.; maps, diagrs., ills., index. *M[eteorol]. O[ffice Publ. No]. 61.* Meteorological Office, London, 1916. 1s.

(2) —— **Seaman's handbook of meteorology, The: A companion to the barometer manual for the use of seamen.** 3rd edit. xxxviii and 202 pp.; maps, diagrs., ills., index. *M*[*eteorol*]. *O*[*ffice Publ. No*]. *215.* Meteorological Office, London, 1918. 3s. 6d.

(3) —— **Marine observer's handbook, The.** 2nd edit. iv and 142 pp.; diagrs., ills., index. *M*[*eteorol*]. *O*[*ffice Publ. No*]. *218.* Meteorological Office, London, 1918. 3s. 6d.

The British Meteorological Office issues a large series of important publications which are by no means so well known, or so widely used, in this country as they deserve to be. This regrettable situation is doubtless due in part to the fact that these volumes are not generally advertised and in part to the fact that many teachers and students who would naturally buy them are under the mistaken impression that all these publications are either highly technical or else are of interest to British readers, and especially to British seamen, only. This is far from being the case. Several of them are of value to every teacher and student of meteorology in the United States. Furthermore, the low price at which these volumes are sold is another reason why they should be widely known in our own country.

(1) The ''Barometer Manual for the Use of Seamen'' is historically an interesting volume, for it is the lineal successor of the barometer manual originally prepared by Admiral Fitzroy. It was first published in 1884 as a revised edition of Fitzroy's book and has been through seven editions, the present issue being the eighth. In all, about 35,000 copies of the work have been distributed. As its title implies, it deals chiefly with the barometer and the method of using it; with pressure and its variations; with the causes and distribution of winds; and with storms and gales in both tropical and extratropical latitudes. The descriptions and explanations are simple, clear, and direct. Excellent charts and numerous figures illustrate the most important topics. One of its most valuable portions is a new introduction, setting forth the most modern views of the structure of the atmosphere and the relation existing between pressure distribution, upper currents, and surface winds. These subjects are not naturally easy for the ordinary reader to understand, but the discussion is admirably clear, and the 25 pages of this introduction might well be included in any modern textbook of meteorology. The rapid progress of the new meteorology may be seen in the free use of such terms as ''cyclostrophic'' and ''geostrophic'' motion and ''katabatic'' and ''anabatic'' winds. The introduction of the new C. G. S. units of pressure and of absolute temperatures is another sign of recent advance, but the older units (inches, hundredths, Fahrenheit degrees) are also included. Furthermore, the general introduction of wireless telegraphy and the possibility of constructing daily weather maps on board vessels at sea, have led to the addition of an appendix containing instructions regarding the transmission of daily meteorological information by wireless from the Eiffel Tower. The two weather charts (Pl. 34), prepared from messages issued by radiotelegraphy from the Eiffel Tower, are in themselves well worth the extremely low price of the manual. The volume is really a historical one, giving the facts of the general atmospheric circulation as far as these are known from observations at sea. But, to quote (p. 25), ''the time has now arrived when seamen *who are interested in meteorology, as well as the weather* [the italics are ours] may be interested to see the direction in which scientific investigation is leading.'' The book itself may be considered as introductory to the Introduction, ''but the facts are still the most important feature, and their representation is still the main purpose of the book.''

(2) ''The Seaman's Handbook of Meteorology'' is more general in character. It is intended for the ocean-going sailor who needs to know the rudiments of meteorology in order to make the most intelligent use of the ''Barometer Manual.'' Emphasis is laid first upon the individual weather elements and then upon weather and upon forecasting, both by weather maps and by observations at a single station, as on board ship. In the discussion of forecasting, of weather types, and of the conditions which bring gales and fog the British Isles and their adjacent water areas are chiefly considered; but much of the very useful and practical information contained in these chapters applies, with slight modifications, to the North Atlantic steamer routes. A chapter on icebergs and other forms of drifting ice is included because of the obvious importance of this subject in navigation and because of the connection which exists between meteorological conditions and the amount and drift of ice at sea. There are also a chapter on instruments and their use, an appendix on the mirage and its effects in causing displacements of the apparent sea horizon, and a general preface by Sir Napier Shaw. The text is by Commander M. W. Campbell Hepworth, Marine Superintendent of the Meteorological Office. Type weather maps, ice charts, cloud views, and other illustrations are included.

The passing of the sailing vessel with the increasing use of steam does not mean that meteorological conditions no longer need consideration in ocean navigation. Far from it. Wind, fog, floating ice, and snow still are, and will always remain, of critical importance to seamen. The ocean liner which steams ahead through a fog is in greater danger of collision with another vessel or with an iceberg than is the sailing ship, which under such conditions is either becalmed or is moving but slowly. And, whatever else may be said, it remains true that ''whatever be the size or power of an ocean-going vessel, her success as a dividend-earner depends upon taking advantage of all circumstances, including the weather.''

(3) As its title indicates, ''The Marine Observer's Handbook'' is a complete set of instructions for the use of captains and officers of vessels conducting observations for the British Meteorological Office. It therefore has special reference to the form of meteorological log which is supplied to British ships. There are, nevertheless, several matters in it which have a general interest, such, e. g., as the difficult problem of the proper exposure of a rain gage at sea and the discussion of waves and swell and optical phenomena.

These three publications, while not designed for use on land or in general meteorological instruction, all contain much of interest and value to any student of meteorology. R. DeC. Ward

Paine, G. P. **Report on modes of air motion and the equations of the general circulation of the earth's atmosphere.** Diagrs., bibliogr. *Monthly Weather Rev.*, Vol. 46, 1918, No. 7, pp. 311-323. Washington, D. C.

It takes a mathematical physicist to appreciate fully the value of this paper, the object of which ''is to classify and to analyze fundamental modes of air motion and to ascertain some of the mathematical laws governing general circulation, a particular mode of motion in the earth's atmosphere.''

''The reason for the apparent failure of the kinetic theory of gases to account for observed air motions is to be found in the fact that the classical equations apply to the instantaneous air drift out of one fixed, microscopic volume element into another, while the motions that actually come under observation are in general of another and fundamentally different mode.

''With a view to removing this difficulty, air motions are classified [and discussed mathematically in detail] in terms of mass motion, molecular motion, winds, and turbulence. Winds are classified with reference to their order [i. e. unit of time used]; and turbulent motions, with reference to their order and to their kind. * * *

''Varied and in some respects conflicting as the data seem to be, the following generalizations seem to have been empirically established. (*a*) Turbulence of the kind under consideration appears in the neighborhood of obstacles, material boundaries and surfaces of discontinuity, and in general where high differential velocities exist between adjacent fluid strata. (*b*) It may appear where the material boundaries and the adjacent fluid strata are at the same temperature. (*c*) A wind of order T [time unit] is in general modified profoundly by the occurrence of superimposed gusts, cross-currents, and eddies—turbulent motions relative to T. In particular, a turbulent wind does not obey the laws * * * governing the mass motion of the gas. On account of the first two of the foregoing generalizations, the kind of turbulence under consideration will be referred to as *kinetic turbulence.* * * *

''*Convective turbulence.* A stream of water at 20° C. and flowing rapidly down an inclined iron trough at the same temperature will exhibit turbulence relative to a general drift corresponding, say, to hourly means. If the temperature of the trough be sufficiently increased, the water will boil as it descends, and the turbulence will thus be enormously complicated by the appearance of a new type of stream-line irregularities. Such irregularities, which are due to temperature differences between material boundaries and their adjacent fluid strata, occur in the lower layers of the atmosphere and operate powerfully to modify atmospheric stream lines. On a fair summer day the process is generally visible. During the morning, the earth becomes hotter than the adjacent air, and heat is conducted from the ground to the lowest air stratum. The resulting vertical instability manifests itself in multitudinous flickering jets rising from the ground. Although these jets are visible only to the height of a few feet, the appearance of cumulus clouds bears witness to the fact that the jets are uniting into massive convection columns which are driven upward to an altitude of perhaps a mile. The structure of higher-order surface winds is profoundly complicated by these enormous air columns cutting across their lines of flow. Relatively lacking in momentum, the ascending masses mix with the currents of the upper air, while irregular downward draughts, replacing the thermally driven masses and transmitting horizontal momentum from the upper air currents to the surface layers, unite into a wind of higher order near the ground, which, making itself first felt in the morning, attains a maximum velocity during the day and disappears during the late hours of the afternoon.

''This mode of motion, *convective turbulence,* is characteristic of regions where the material boundaries and the adjacent air strata are at different temperatures. It accordingly differs essentially from kinetic turbulence with regard to its origin; possibly also with regard to characteristic stream-line configurations. * * *

''But in the results of observation there is generally little or nothing to enable one to distinguish between kinetic and convective turbulence. Near the earth the two phënomena combine to the extent that the atmosphere has well been called a 'treacherous sea,' where irregular cross currents and eddies, violent swirls, and sudden side gusts prevail.''

At the end of the paper there is a bibliography of 104 references to contributions by 80 different authors. CHARLES F. BROOKS

SHAW, NAPIER. **The weather map: An introduction to modern meteorology.** 4th issue. 109 pp.; maps, diagrs., index. *M[eteorol]. O[ffice Publ. No]. 225 i.* London, 1918. 4d.

—— **Meteorological glossary, in continuation of "The Weather Map" (M. O. 225 i).** 4th issue. 358 pp.; maps, diagrs., ills. *M[eteorol]. O[ffice Publ. No]. 225 ii.* London, 1918. 1s.

To write ''an introduction to modern meteorology'' within less than 50 pages of a small-sized book costing but fourpence would seem an impossible task. But Sir Napier Shaw has done it and done it well. ''The Weather Map'' has a distinct war bearing, as is seen in the opening paragraphs on meteorology and military operations; in the section on the meteorologist at the headquarters of a modern army; and in the climatic summaries for London, Paris, Philippopoli (Balkans), Babylon (Mesopotamia), Helwan Observatory (Egypt), and Dar es Salam (East Africa). But the little volume has a more permanent interest than that associated with the war. It presents some of the fundamental facts of modern meteorology in so clear, so concise, and so simple a way that it is not only interesting reading but is highly instructive as well.

About half of the volume is devoted to the climatic summaries for one station in each of the principal British war areas, illustrated by a series of excellent charts and diagrams. Several maps illustrate typical weather conditions of the British Isles.

It is not often possible to say, with truth, that a book is absolutely indispensable to a worker in any department of science. Such a statement can, however, be made of the ''Meteorological Glossary'' and without fear of contradiction. We have here, closely packed into about 350 pages, explanations of technical terms which are in more or less frequent use by meteorologists—explanations often so complete that they suffice for all purposes of ordinary teaching or study. The ''Glossary'' is stated to be a continuation of ''The Weather Map'' referred to above, but it has a far wider range of usefulness than that statement implies. It is true that cross references in the ''Glossary'' make it highly desirable for those who use it to have also copies of ''The Weather Map'', as well as of the ''Observer's Handbook'' and of the ''Computer's Handbook'', all issued by the Meteorological Office. But the ''Glossary'' is absolutely indispensable even without those additional volumes and should henceforth be on the desk of every meteorological worker. The discussions were written by experts connected with the British Meteorological Office; the revision of the work for the present fourth issue was carried out by Dr. C. Chree, F.R.S., Superintendent of the Kew Observatory, and the direction of the whole undertaking was in the hands of Sir Napier Shaw. No more than that need be said to establish the fact that the work is authoritative, up to date, and complete. It is hardly necessary to select any sections for special mention, but attention may perhaps be called to the present interest of the discussions of airplane weather, the new pressure units, harmonic analysis, and wireless telegraphy in relation to meteorology. Meteorologists the world over are indebted to the British Meteorological Office for many valuable publications, but the new issue of the ''Glossary'' is distinctly the most generally useful of all. It is the working meteorologist's absolutely indispensable *vade mecum.*

R. DEC. WARD

DINES, W. H. **Meteorology in relation to aeronautics: A review of the data required by an aviator when in the air.** Diagrs. *Scientific American Suppl.,* No. 2239, Vol. 86, 1918, November 30, pp. 351-352; No. 2240, December 7, pp. 366-368. [''A paper read before the Aeronautical Society of Great Britain, and published in the *Aeronautical Journal.*'']

GUILBERT, GABRIEL. **Sur la prévision des variations barométriques.** *Comptes Rendus de l'Acad. des Sci.* [*de Paris*], Vol. 168, 1919, No. 18, pp. 899-902.

THE
GEOGRAPHICAL REVIEW

VOL. VIII OCTOBER-NOVEMBER, 1919 NO. 4-5

THE NORWEGIANS IN SPITSBERGEN*

By CHARLES RABOT
Société de Géographie de Paris

[With Figs. 3 and 4 on Pl. III facing p. 212 and Figs. 13, 14, and 15 on Pl. IV facing p. 224.]

Several papers concerning Spitsbergen have recently been published, but they are incomplete and inaccurate, their authors being unaware of the great work done by the Norwegians in this archipelago and of the recent historical research work of the Dutch. It may therefore be useful to attempt to present a comprehensive account of geographical progress in Spitsbergen and of the industrial development of this polar land as well as its political history.

ICE CONDITIONS ON SPITSBERGEN COASTS

Owing to the climatic effects of a branch of the Gulf Stream, the western coast of Spitsbergen and the westernmost part of its northern coast are usually ice-free from July to October. Sometimes the western coast is open until December. In 1892, on July 29, 30, and 31, between Jan Mayen and Ice Fiord, I did not see a single cake of ice. Thanks to these circumstances tourist-crowded liners in service before the war used to push up from the northwestern corner of Spitsbergen as far as the eightieth parallel to let their passengers enjoy a view of the polar pack. In no other part of the world can one reach so high a latitude in open water.

By contrast, a polar current flowing past eastern Spitsbergen, carrying a large amount of ice, blocks the eastern coast of Northeast Land, Barents Island, and Edge Island. Off the southern coast of the last-named island a branch of this current takes a westerly direction, rounds South Cape, and runs northward between the Gulf Stream and the western coast of Spitsbergen, carrying masses of ice which generally disappear by early summer.

Such is the normal state of the ice, but it may be interfered with by the winds. In spring and summer northern and eastern winds prevail,

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* Special interest attaches to this article in view of the newspaper report from Paris that the Supreme Council of the peace conference on November 21 "approved the text of an agreement granting political suzerainty over the Spitsbergen archipelago to Norway."—EDIT. NOTE.

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the polar pack drifts southward and closes the generally open waters off the northern coast, whilst the eastern ice drifts southward also, opening Stor Fiord and the sea off the eastern coasts of Northeast Land, Barents Island, and Edge Island. A great deal of this ice skirts South Cape and arrives on the western coast at the southern point of Prince Charles Foreland. In 1915 so much eastern ice gathered on the western coast that Bell Sound and Ice Fiord were blocked and navigation was very difficult until the end of August. Probably not since the discovery of Spitsbergen, certainly not in the last fifty years, had the western coast been so obstructed by ice.

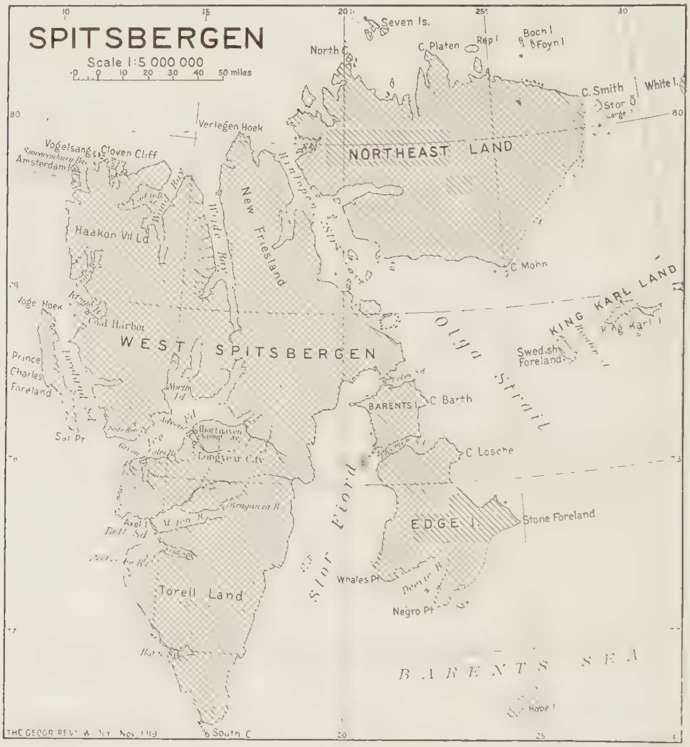

FIG. 1—Sketch map of Spitsbergen. Scale, 1:5,000,000.

It also happens, but very rarely, that, owing perhaps to the greater flow of the Gulf Stream, the sea all about Spitsbergen remains open the greater part of the summer, and in such seasons the circumnavigation of the archipelago becomes possible. This was the case in 1918 and, before that, in 1886, 1887, 1898, and 1899.

History of Exploration

The story of the geographical exploration of Spitsbergen can be divided into three periods: (1) the Dutch-English, which lasted until the beginning

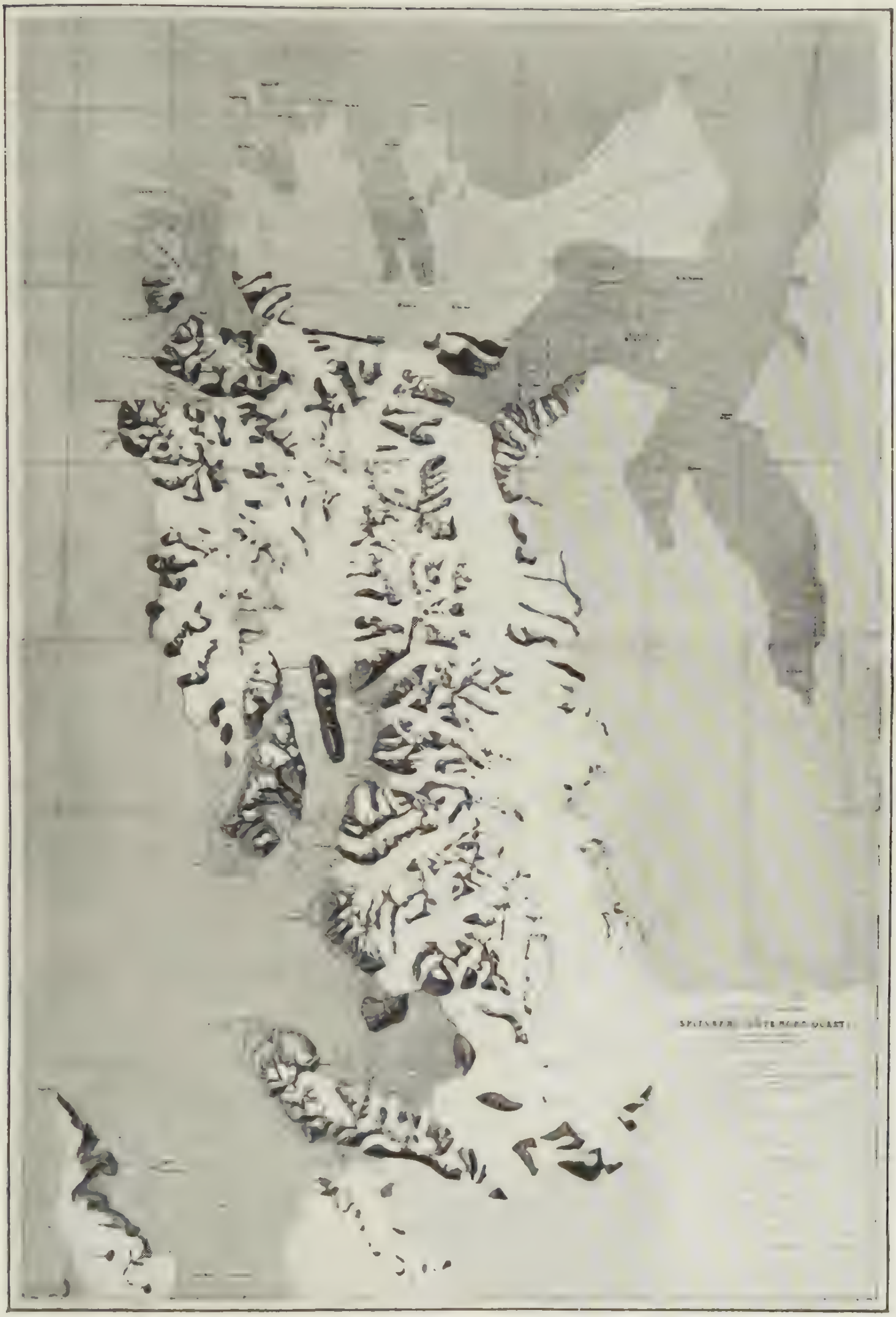

FIG. 2—Photograph of the map of the northwestern part of West Spitsbergen, 1:100,000, surveyed on Captain Gunnar Isachsen's expedition of 1906 under the auspices of the Prince of Monaco (see footnote 3). Reduced scale 1:790,000. Relief and glaciers are shown in contours and shading. A similar map, 1:200,000, with relief and glaciers in contours, has since been published by Captain Isachsen (see footnote 4). These maps are indicative of the recent scientific work done by the Norwegians in the interior of Spitsbergen, work which is still continuing.

of the eighteenth century; (2) the Norwegian-Swedish, between the end of the eighteenth century and the opening of the twentieth century; (3) the Norwegian, since 1906.

DUTCH-ENGLISH PERIOD

The old Icelandic annals regarding the discovery of Spitsbergen by Norwegians in the eleventh century are vague, and the journey of Willem Barents in 1596 is considered as the first authenticated voyage to this Arctic land. The celebrated Dutch seaman visited only the western coast and a part of the northern coast of the main island, and the discovery of the other islands has been credited to English "adventurers" of the Muscovy Company. But this claim must be revised. The globe of the Dutch cosmographer Plancius, engraved in 1612 and newly discovered by Dr. F. C. Wieder, delineates the northern coast beyond Hinlopen Strait, the Seven Islands, the western and southern coasts of Edge Island, and Hope Island. Thus, previous to the English, even "before 1614, the entire circumference of Spitsbergen was known to the Dutch, except the vicinity of Heley Sound (Helis Sound) and the east coast of North-East Land and Edge Island, so that the Dutch may rightly be called the discoverers of the entire Spitsbergen group."[1]

About the middle of the seventeenth century, whilst the English whale fishery declined, the Dutch whaling industry had a rapid development, which was of great advantage to geography. Returning home, the Dutch whalers gave to the cosmographers of Amsterdam information concerning Spitsbergen, so that in Holland there was continuous and uninterrupted progress in the cartography of these polar islands. From 1594 to 1829, according to Dr. Wieder, more than two hundred maps of Spitsbergen were published in the Netherlands. To the Dutch we are indebted for the first cartographical documentation concerning these islands. During two and a half centuries the Dutch were the masters of the cartography of Spitsbergen.

NORWEGIAN-SWEDISH PERIOD

Toward the end of the eighteenth century the Dutch whale fishery declined, and the Norwegians arrived at Spitsbergen in order to hunt the walrus, seal, polar bear, and reindeer in summer. Their activity was at that time limited to the western coast and to the easily accessible part of the northern coast. In 1827 B. M. Keilhau, professor at the University of Christiania, chartered one of these sealing vessels and paid a short visit to Bear Island and Spitsbergen. This was one of the first scientific expeditions to these islands and one of the most successful. The geological, paleonto-

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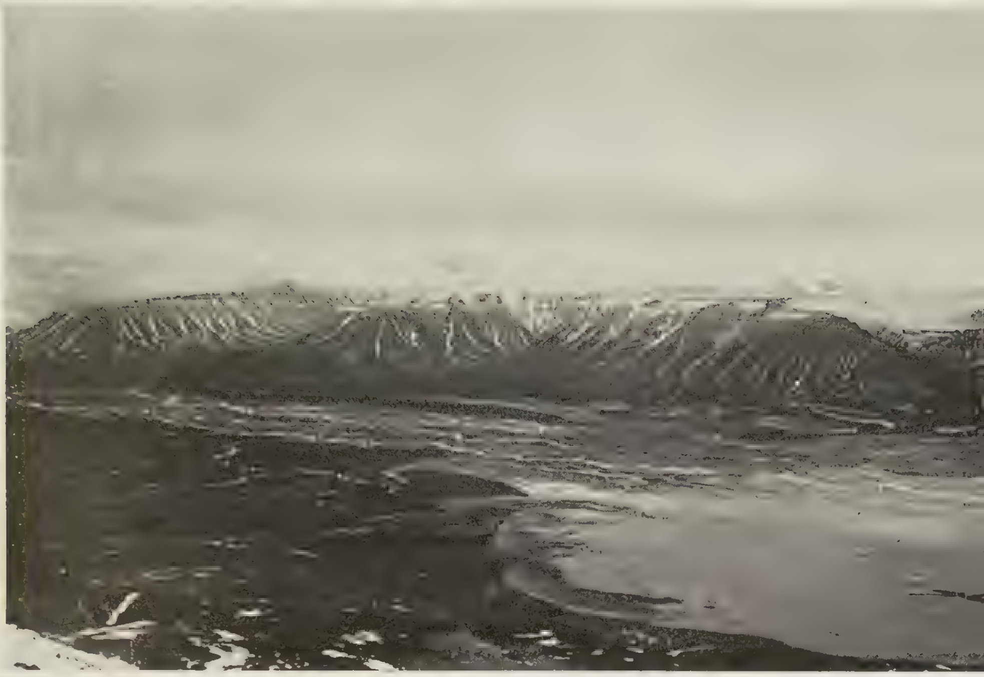
[1] The Dutch Discovery and Mapping of Spitsbergen (1596-1829). Edited by order of the Dutch Minister for Foreign Affairs by Dr. F. C. Wieder. Published by the Netherland Ministry for Foreign Affairs and the Royal Dutch Geographical Society, Amsterdam, 1919. [This splendid volume contains the reproduction of 83 maps of Spitsbergen between 1596 and 1829.]



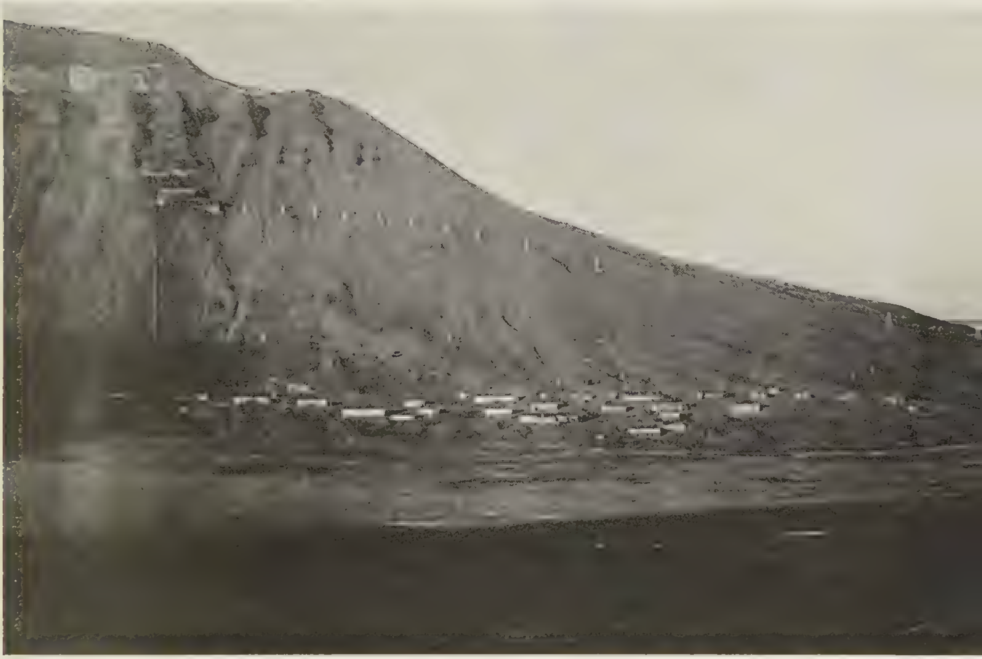


Fig. 3—Panorama of Advent Bay seen from the coal mine at Hiorthaven (formerly Advent City) on its northea and the opening of the bay into Ice Fiord. The glaciated plateaus of the farther shore are typical of the who Engineer Alfred Koller.)

Fig. 4—General view of the coal mine at Longyear City. The mine lies on the western side of a small tributar The houses at the foot of the slope are Longyear City (for close view of the harbor and Longyear City see Figs. 5 a The Norwegian colliery at Hiorthaven, formerly the British mining town of Advent City, lies on the opposite, nort

For locations in the Advent Bay region see the map of central Spitsbergen, 1:300,000, by Gerard de Geer, *Ymer*,

delta of the river draining Advent Valley, the drift ice in the middle portion of the bay (note the steamer as scale). of the prominent U-valley in the center lies the coal mine at Longyear City, shown in the figure below. (Photo by

the hillside to the left with a cableway leading from it down to the harbor on Advent Bay in the center of the view. f Boston, Mass., but in 1915 was sold to the Great Norwegian Spitsbergen Coal Company, a Norwegian syndicate. oto by Professor Adolf Hoel.)

logical, and botanical studies which Keilhau had the opportunity of making during his voyage are fundamental. In 1837 the Swedish professor S. L. Lovén also made a scientific trip to the western coast in a Norwegian vessel.

In 1858 the second chapter of the history of Spitsbergen opens with the geographical exploration of the archipelago both by Swedish scientific expeditions and by Norwegian walrus hunters. From 1858 to 1908 twenty Swedish expeditions went to Spitsbergen under the leadership of scientists like Otto Torell, A. E. Nordenskiöld, A. G. Nathorst, Baron Gerard de Geer, and others. Besides valuable scientific studies they published in 1865 the first chart of the archipelago based on surveys. This chart has been the basis for later ones representing fresh discoveries. The British Admiralty's chart, for example, reproduces the results of the Swedish surveys.

Discoveries by Norwegian Walrus Hunters

During the second half of the nineteenth century no Norwegian scientist took part in the exploration of Spitsbergen. Nevertheless important discoveries were made by Norwegians. About the year 1850 game became scarce in the easily accessible parts of Spitsbergen, and Norwegian walrus hunters sought new grounds in the generally ice-blocked waters stretching northward and eastward and made important discoveries in the hitherto unknown eastern parts of Spitsbergen.[2]

The first step in this direction was taken in 1847 when Captain Lund navigated Thymen Sound, between Edge Island and Barents Island, for the first time. At that time Barents Island was not known to be an island; it was represented as a large foreland of West Spitsbergen, and Heley Sound was shown as a fiord. In 1858 Captain Johan Nilsen crossed this inlet from sea to sea, demonstrating the supposed fiord to be a strait. By this discovery the features of eastern Spitsbergen were also completely changed. In 1859 another Norwegian seal hunter, the well-known Elling Carlsen, cruising eastward of Edge and Barents Islands, found himself near an unknown land. This was the islands now named King Karl Land but then identified with Giles Land, an island seen in 1707 by Commander Giles, the position of which remained uncertain at this date. Three years later, in 1861, Carlsen for the first time circumnavigated the whole archipelago—a splendid achievement. During this cruise the true nature of Northeast Land was ascertained. It was discovered that the eastern coast of this large island is entirely occupied by a great glacier discharging into the sea and forming the eastern outflow of an inland-ice mass which covers the whole island. In 1864, off the eastern coast of Northeast Land, another gallant Norwegian hunter, Tobiesen, rediscovered Stor Ö (Large Island), seen by Dutch whalers in the seventeenth century.

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[2] The survey of the Norwegian exploration of Spitsbergen here given summarizes a statement compiled by order of the Norwegian Government by Adolf Hoel, of the University of Christiania, the leading Norwegian explorer of these islands in recent years.

In 1867, Rönnback circumnavigated West Spitsbergen and discovered a group of small islands on the western coast of Hinlopen Strait in 79° N.

In 1871, an English sportsman, B. Leigh Smith, chartered a Norwegian schooner under the command of Captain Ulve, an expert Norwegian ice navigator. Reaching the southern and later the northern coast of Northeast Land, they stated that this land stretched about 43 nautical miles farther eastward than was formerly believed.

In the following year knowledge of eastern Spitsbergen was advanced by Norwegian seal hunters. Taking advantage of an open season, Altman, Johnsen, and Nielsen reached King Karl Land and reported that there were several large and small islands divided into two groups by a large sound. Johnsen landed on the northeastern point of the eastern group.

In 1876 and 1887, eastward of the northeastern point of Northeast Land, two Norwegian walrus hunters, Kjeldsen and E. H. Johannesen, came in sight of an unknown island, White Island, the true Giles Land. In 1889, another Norwegian walrus hunter, Hemming Andreassen, completed our knowledge concerning King Karl Land by navigating the northern part of the sound dividing the two main islands, Svenska Förland (Swedish Foreland) and King Karl Island. This sound was called Rivalen Sound from the name of Andreassen's ship. According to Professor Nathorst, the sketch map of this Norwegian walrus hunter was not superseded until the survey of this group of islands was made by the Swedish expedition of 1898; it is, however, much more accurate than the map that Dr. W. Kükenthal, the well-known zoölogist of Jena, published after visiting King Karl Land in a Norwegian hunting sloop that same summer. So strong is respect for established authority in old Europe that in a new issue of their maps of Spitsbergen the British and French hydrographic offices reproduced the incorrect sketch made by the German scientist rather than the accurate one by the Norwegian skipper.

Finally, in 1898, Norwegian hunters, starting from the northeastern corner of Northeast Land, discovered beyond White Island a new island, which they named Victoria Island. These seamen also reported that Spitsbergen and Franz Josef Land have a fringe of islands between them. These two polar lands form a dam which prevents the polar pack from flowing southward in great masses. To this circumstance northern Europe is indebted, in part, for its relatively mild climate.

To summarize, we may say that in eastern Spitsbergen the Norwegian walrus hunters did admirable pioneer work, opening the way for further scientific expeditions. Also, geography is indebted to them for determining the directions of ice drift around Spitsbergen.

In order to complete the description of the contributions to our knowledge of Spitsbergen made by Norwegian hunters, it must be added that, of the trappers who have been wintering in the islands since the last years of the nineteenth century to catch bear and fox, eighteen parties made

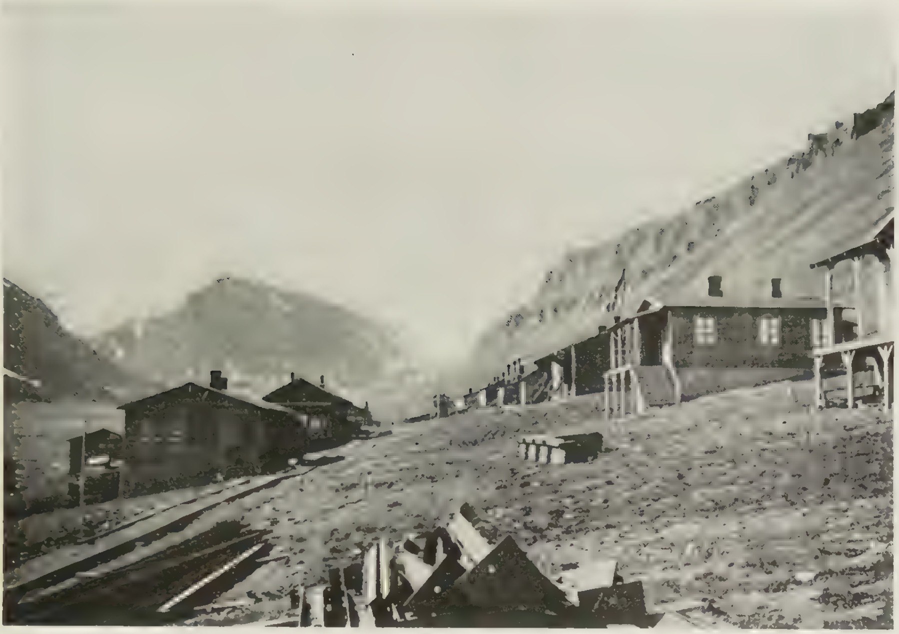

Fig. 5

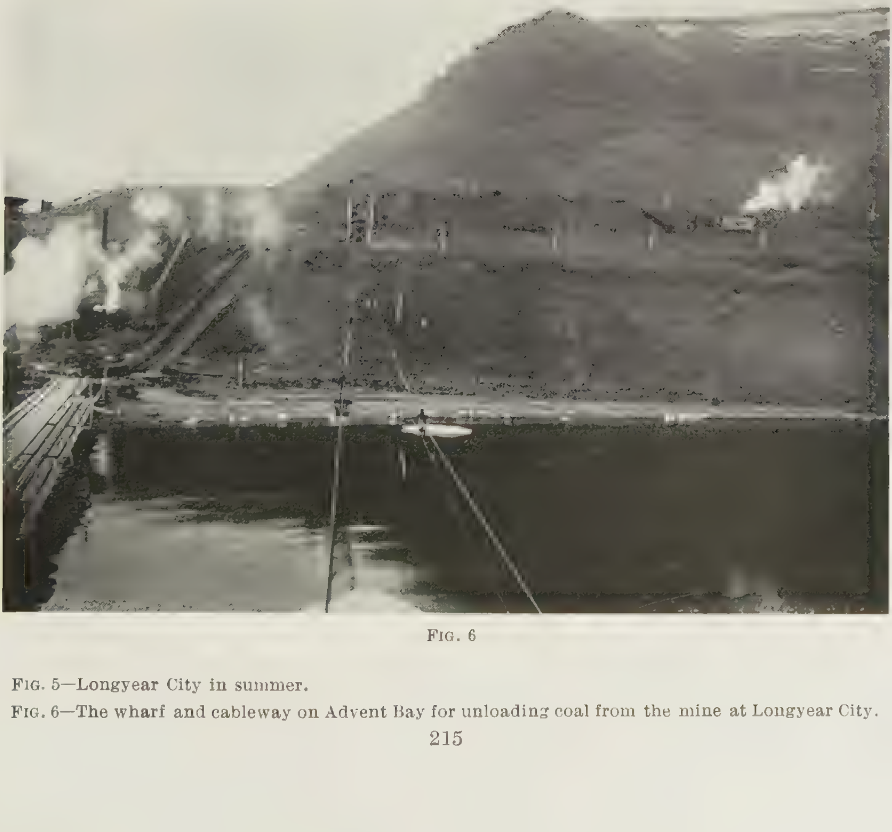

Fig. 6

Fig. 5—Longyear City in summer.

Fig. 6—The wharf and cableway on Advent Bay for unloading coal from the mine at Longyear City.

regular meteorological observations, both on the western and the eastern islands, with instruments lent by the Meteorological Institute of Christiania, and thus added substantially to our knowledge of the climatology of this Arctic land.

Recent Norwegian Scientific Exploration in the Interior

In 1906 the last chapter in the exploration of Spitsbergen was begun by Norwegian scientists, using new methods of exploration. Until then few expeditions had been undertaken in the interior, so that practically the whole inland portion of the islands remained a *terra incognita.* In 1906, the Prince of Monaco, having taken Spitsbergen waters as a field for oceanographical research, began the systematic survey of the western island. Establishing his headquarters in Cross Bay, he entrusted the mapping of the mountainous massifs stretching from that bay to Smeerenburg Bay to Captain Gunnar Isachsen of the Norwegian army, who had been the topographer of Sverdrup's expedition to the American Arctic Archipelago. With a staff of Norwegian surveyors and naturalists and with Dr. Louet of the French army, Captain Isachsen admirably fulfilled his task in two summers.

The results are of great value.[3] About 200 square miles of Spitsbergen's ice world were mapped by accurate methods on the scale of 1:100,000 with contours of elevation. Never before had such a great area of the interior of Spitsbergen been surveyed, nor an Arctic land mapped so accurately. This successful expedition aroused in Norway a still greater interest in this region. The Norwegian parliament and private citizens granted large subsidies for pursuing the work initiated by Isachsen. Henceforward the foundations were laid for a systematic survey of the western fiord region of West Spitsbergen, and every summer thereafter one or two Norwegian expeditions went to this island.

In 1907 and 1910 a large expedition set off under the command of Captain Isachsen, numbering, besides the leader of the expedition, nine scientists. Extending in all directions the survey made on behalf of the Prince of Monaco, they brought back maps of northwestern Spitsbergen between the northern coast, Wijde Bay, and Ice Fiord, of the region adjoining Green Harbor in the last-named fiord, and of Prince Charles Foreland.[4] During the two summers in which the expedition was in the

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[3] The scientific results of the expedition are laid down in the splendid series of monographs published by the Prince of Monaco under the title "Résultats des campagnes scientifiques accomplies sur son yacht par Albert Ier, Prince souverain de Monaco," Fascicules 40 (surveys; with the map, 1:100,000, showing relief and glaciers in contours and shading, reproduced in Fig. 2 of the present article), 41 (glaciology 42 (geology and physiography), 43 (geology), 44 (botany).

[4] The geographical results are contained in:

Gunnar Isachsen: Travaux topographiques de l'expédition Isachsen, 1909-1910, *Kristiania Videnskapsselskapets Skrifter: I. Mat.-naturv. Klasse,* 1915, No. 7 (=pp. 1-63). [Contains the map of northwestern Spitsbergen in 1:200,000, showing relief and glaciers in contours.]

Idem: Green Harbour, *Norske Geogr. Selskaps Aarbok,* 1912-13, pp. 151-162. [With a map of Green Harbor in 1:100,000.]

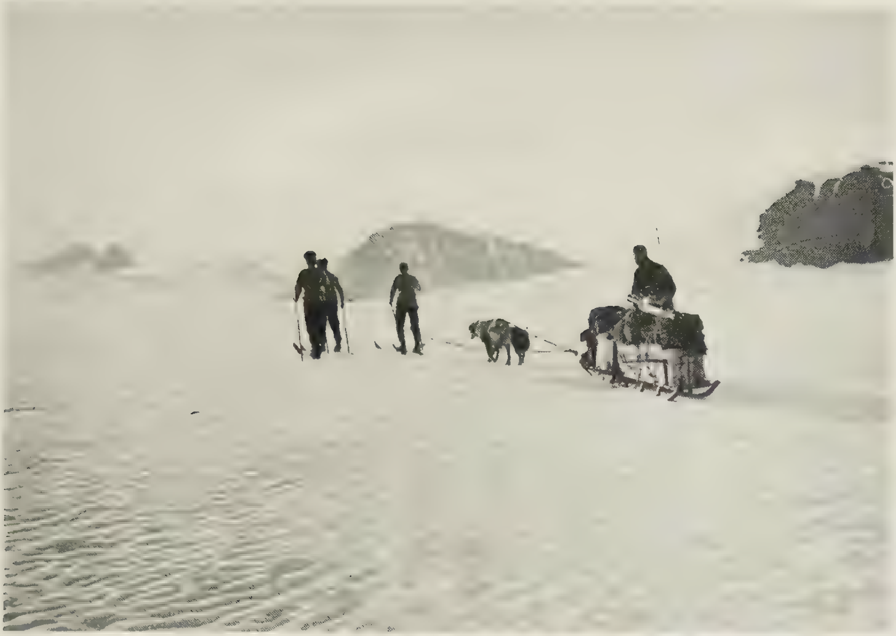

FIG. 7

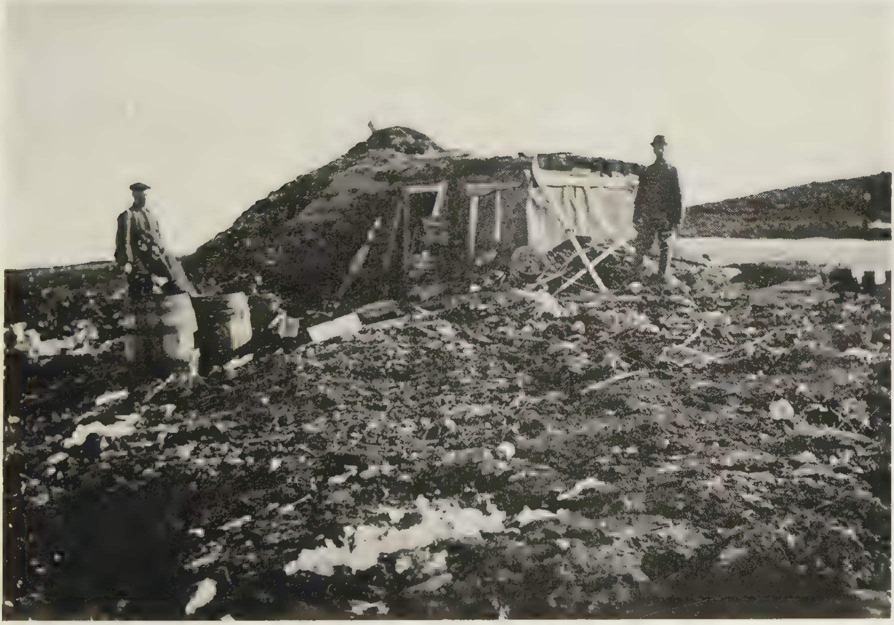

FIG. 8

FIG. 7—Traveling over the ice field toward the Three Crowns, the three summits seen in the left background, east of Kings Bay (western coast of West Spitsbergen, 79° N). (Photo by Captain Gunnar Isachsen, expedition of 1909-1910.)

FIG. 8—Winter hut of Norwegian trappers at Safe Harbor, northern shore of Ice Fiord. (Photo by Dr. Holtedahl, 1909.)

field more than 2,000 square miles were mapped, and a great quantity of geological data was gathered.

From 1911 to 1918, under the leadership of Adolf Hoel and Captains Arve Staxrud and Sverre Rövig, topographical and geological surveys were extended to the peninsula between Ice Fiord and Bell Sound and southward to the coastal region as far as Horn Sound. The work of the Norwegians in Spitsbergen from 1906 until 1918 may therefore be summarized as follows:

All the western coastal region as far as a point lying three statute miles south of Horn Sound is now accurately triangulated and mapped in detail.[5] That is a piece of land about 200 statute miles long and 18 to 58 miles wide, covering 5,600 square miles. For the northern sheets the scale of 1:200,000 has been adopted, and for the southern sheets 1:100,000 and 1:50,000. All these maps will soon be published; a chart of the western coast of Spitsbergen, more nearly correct and more complete than the British and German charts, has already been published by the Norwegian Hydrographic Office.[6] In the coming years the survey will be continued southward; it is hoped to reach South Cape by 1922.

These expeditions also attained geological results of exceptional value. The chief points of interest about these researches are the study of the Devonian on the northern shores, the discovery of Quaternary volcanoes and of hot springs on the western shore of Wood Bay,[7] and the true determination of the age of the massifs of crystalline schists in the northwestern corner. These schists, ascribed to Archean, belong to the upper Hecla Hoek series (Silurian).

Besides these systematic expeditions, there were several others equally successful.

In 1908, Mrs. Hanna Resvoll-Holmsen made a botanical survey of the fiord region in West Spitsbergen. The same year and again in 1912 her husband, Dr. Gunnar Holmsen, carefully studied the numerous strata of fossil ice[8] whose existence in the soil of Spitsbergen was discovered in 1892 by the author of this paper.

GLACIAL FEATURES OF WEST SPITSBERGEN

Thanks to the Norwegian expeditions, the peculiar glacial phenomena of West Spitsbergen can now be outlined. In the northwestern corner there is no ice sheet. The former inland ice, which had totally covered the region, has shrunk, and now alpine crests rise above the ice to heights of 4,200 feet and delineate great ice streams. But eastward from a line joining Cross Bay with the head of Wood Bay the alpine crests merge into ice-covered plateaus. As reckoned by Isachsen, the glaciated area in the coastal region extending from Smeerenburg Bay and Liefde Bay to Cross Bay is 67 per cent of the total area. On the other hand, the great peninsula between Ice Fiord and Bell Sound with large plateau massifs divided by wide valleys bears no arctic character. In that part of Spitsbergen the glaciation is only local. The large valleys are bare in summer and have boggy soils and meager pastures. Forty years ago numerous herds of reindeer were to be found there in autumn. Southward from Bell Sound and around Horn Sound there is a rugged land with large coalescing glaciers issuing from an ice sheet occupying the interior back of the high coastal crests.

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[5] Besides the Norwegian surveys there should be mentioned the map of Prince Charles Foreland, 1:140,000, by Dr. W. S. Bruce and M. J. Mathieson, published in 1913 by the Scottish Oceanographical Laboratory of Edinburgh with the support of the Prince of Monaco.

[6] Spitsbergen: Farvand og Ankerpladser paa Vest- og Nordkysten, 1:200,000, with seven insets, Norges Geografiske Opmaaling Chart No. 198, Christiania, first edition, 1912.

[7] A. Hoel and O. Holtedahl: Les nappes de lave, les volcans et les sources thermales dans les environs de la baie Wood au Spitsberg, *Kristiania Videnskapsselskapets Skrifter: I. Mat.-naturv. Klasse*, 1911, No. 8 (=pp. 1-37).

Adolf Hoel: Nouvelles observations sur le district volcanique du Spitsberg du nord, *ibid.*, 1914, No. 9 (=pp. 1-33).

[8] Gunnar Holmsen: Spitsbergens jordbundis og de bidrag dens undersøkelse har kunnet gi til forstaaelsen av de i arktiske land optraedende varige isleier i jorden, *Norske Geogr. Selskaps Aarbok*, 1912-13, Christiania, pp. 1-132, with summary in German, pp. 133-150.

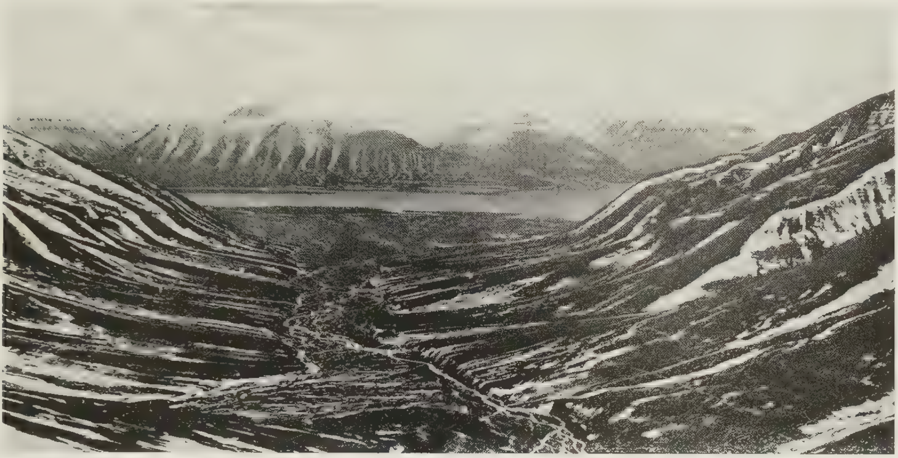

FIG. 9—The Mälar Valley looking down (southwest) to its junction with Advent Valley. The plateau on the far side of Advent Valley is the same as that seen on the left in Fig. 3. (Photo by Engineer Koller, 1917.)

THE SURROUNDING SEAS

The Norwegians have explored not only Spitsbergen, but also the surrounding seas. The first undertaking of this nature was the classic Norwegian deep-sea expedition headed by Mohn, Sars, and Danielssen which explored the Arctic Ocean from Iceland to Jan Mayen, Bear Island, and Spitsbergen (1876-1878). Later on, in 1900, Hjort and Nansen carried out a very valuable oceanographic cruise in the Arctic Ocean as far as Bear Island. In 1901, before starting on his Northwest Passage expedition, Roald Amundsen, on his celebrated *Gjöa,* investigated the oceanographic conditions around Spitsbergen.[9] During Isachsen's expedition in 1909 a great many vertical series of deep-sea observations were made.[10] Finally, in 1912, on his small yacht, Nansen investigated the waters of the western and northern coasts of Spitsbergen.[11]

The foregoing summary demonstrates the fundamental nature of the work the Norwegians have done in Spitsbergen. No other nation compares with them in their geographical discoveries, the number and accuracy of their surveys, and the extent of their scientific results in this archipelago.

FIG. 10—Kings Bay from Coal Harbor, the mining settlement of the Norwegian Kings Bay Coal Company on its southern shore. On the right is shown the terminus of the most northerly railroad in the world (78° 56′ N.). The line, 1½ miles long and of 36-inch gage, carries the coal from the mine to the harbor.

Industrial Development

COLLIERIES

With the twentieth century a new era begins in the history of Spitsbergen. Until then the archipelago had remained uninhabited, but during the past few years it has become a mining land and attracted a considerable number of Norwegian settlers. Coal deposits were long known to exist on the shores of Ice Fiord, but not until the first years of this century were they worked.

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[9] Fridtjof Nansen: Northern Waters: Captain Roald Amundsen's Oceanographic Observations in the Arctic Seas in 1901. *Kristiania Videnskapsselskapets Skrifter: I. Mat.-naturv. Klasse,* 1906 No. 3 (=pp. 1-145).

Björn Helland-Hansen and Fridtjof Nansen: The Norwegian Sea: Its Physical Oceanography Based upon the Norwegian Researches 1900-1904 (Reports on Norwegian Fishery and Marine Investigations, Christiania, 1909, Vol. 2, No. 2). [A standard work.]

[10] Björn Helland-Hansen and Fridtjof Nansen: The Sea West of Spitsbergen: The Oceanographic Observations of the Isachsen Spitsbergen Expedition in 1910, *Kristiania Videnskapsselskapets Skrifter: I. Mat.-naturv. Klasse,* 1912, No. 12 (=pp. 1-89).

[11] Fridtjof Nansen: Spitsbergen Waters: Oceanographic Observations during the Cruise of the "Veslemöy" to Spitsbergen in 1912, *Kristiania Videnskapsselskapets Skrifter: I. Mat.-naturv. Klasse* 1915, No. 2 (=pp. 1-132).

At present the best-developed collieries in Spitsbergen belong to Norwegian companies.

The Great Norwegian Spitsbergen Coal Company is working the most productive coal seams on the island on the western side of Advent Bay, which it bought in 1915 from the Arctic Coal Company of Boston, Mass.[12] From 1909 to 1915 the total exportation of coal by the Boston company amounted to 150,000 tons. In the three following years it amounted to 85,000 tons.[13] This year (1919) the Norwegian company was also to start the exploitation of another coal deposit at Green Harbor.

The Norwegian Kings Bay Coal Company is working on the south shore of Kings Bay.

There are in addition four other Norwegian coal companies now beginning development. One has bought the holdings of an English company on the northeastern side of Advent Bay and will resume work this year. The capital invested in the six Norwegian collieries amounts to $4,200,000.

After the Norwegians come the Swedish Spitsbergen Coal Company, working on both sides of Braganza Bay (Bell Sound), and a Russian company working between Green Harbor and Coles Bay under the management of a Norwegian engineer.

The British are far behind, with two companies: the Scottish Spitsbergen Syndicate, headed by Dr. W. S. Bruce, and the Northern Exploration Company. Several years ago Dr. Bruce did some mining work on coal seams on Prince Charles Foreland, but nothing further seems to have come of it. The Northern Exploration Company has quarried a conglomerate which was taken for marble on the north shore of Kings Bay. This stone is said to be of little value, and it is asserted that none has been exported. The same company also claims an iron-ore deposit in Recherche Bay (Bell Sound) which is emphatically proclaimed to be one of the richest of the world. Scandinavian geologists who have studied this deposit are not of the same opinion. The Northern Exploration Company has recently undertaken preparatory work for mining coal on an island in Bell Sound.

The table, on page 223, of coal exportation and of the number of workmen at each mine summarizes the activity of the different nations in Spitsbergen in 1918.

Settlements and Population

Advent Bay is the chief population center of Spitsbergen. On its western side lies Longyear City, the most important settlement of the archipelago, and now belonging to the Great Norwegian Spitsbergen Coal

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[12] Cf. *Geogr. Rev.*, Vol. 7, 1919, p. 318.

[13] All the statistical data concerning the present economic status of Spitsbergen are taken from an official statement prepared by the Norwegian Government which will be issued several months hence.

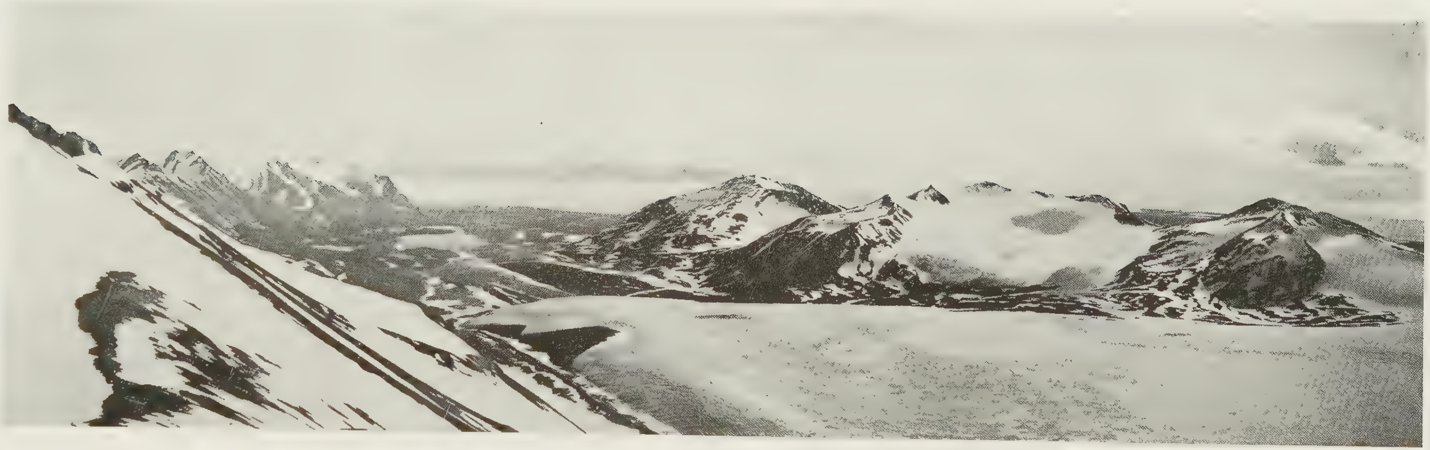

Fig. 11

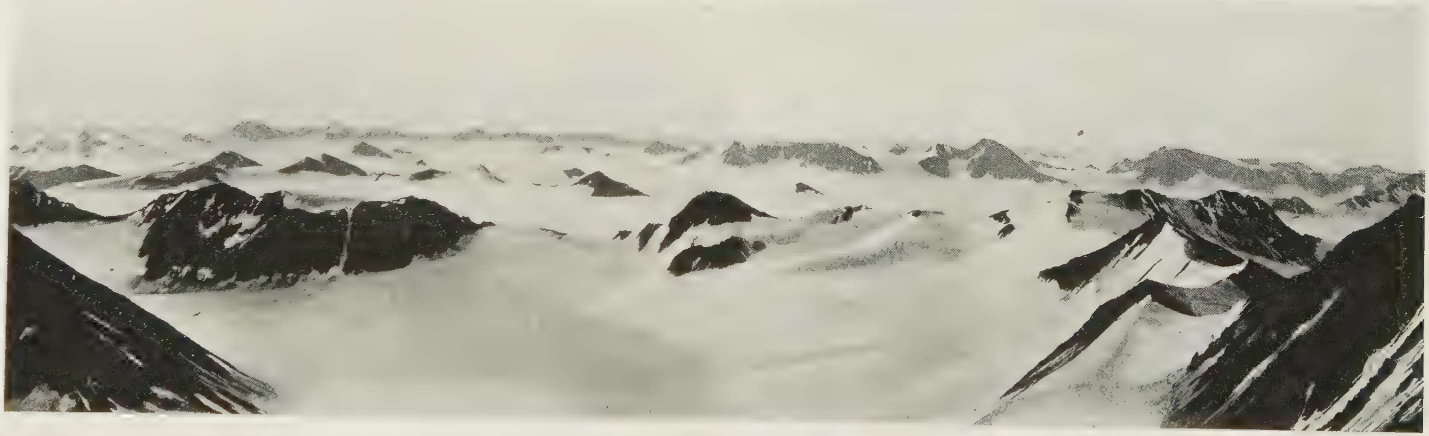

Fig. 12

Fig. 11—Looking south down Erdmann Glacier (right and center foreground) and its outlet valley to the further shore of Bell Sound (in the background). The massif on the right is Mt. Conway, that on the left, South Halland Ridge. (Photo by Engineer Koller.)

Company. It offers very good accommodations, comfortable houses, electric light—the last very necessary indeed during the four months of long polar night. There are also a telephone system, well-stocked stores, and a hospital attended by a physician. In the summer of 1918 Longyear City numbered 300 inhabitants, all Norwegians. On the opposite side of the bay there is another Norwegian settlement, Hiorthaven.[14] Its population, entirely Norwegian, does not exceed 100 souls in summer and 60 in winter.

TABLE I—EXPORT OF COAL FROM SPITSBERGEN

COMPANY	EXPORT IN 1918 (TONS)	NUMBER OF WORKERS	
		SUMMER 1918	WINTER 1918-1919
Great Norwegian Spitsbergen Coal Company	40,000	320	300
Norwegian Kings Bay Coal Company	15,000	300	164
Norwegian Colliery Spitsbergen Company (northeastern side of Advent Bay)	0	100	60
Swedish Spitsbergen Coal Company	4,000	80	?
Russian company under Norwegian management	2,500	40	?
Northern Exploration Company	0	50	?

Besides these there are, on the southern shores of Ice Fiord, two small Norwegian hamlets, one on land owned by the Russian company between Coles Bay and Green Harbor, and another in Ice Fiord, near the coal deposits belonging to the Great Norwegian Spitsbergen Coal Company. On the southern shore of Kings Bay a large Norwegian settlement has been built near the Norwegian colliery, and on an island of the same fiord are some houses belonging to the Northern Exploration Company. In Bell Sound, besides small Norwegian hamlets on both sides of the fiord, there are in Braganza Bay a Swedish village near the Swedish mine and a British settlement on Axel Island.

During the past summer the Norwegian population of Spitsbergen amounted to about 800 souls.

COMMERCE AND COMMUNICATIONS

Among Spitsbergen shipping the Norwegian flag takes first rank:

TABLE II—NORWEGIAN SHIPPING TO AND FROM SPITSBERGEN

	ARRIVALS AT SPITSBERGEN FROM NORWEGIAN HARBORS		ARRIVALS IN NORWEGIAN HARBORS FROM SPITSBERGEN	
	SHIPS	NET TONNAGE	SHIPS	NET TONNAGE
1904	..	......	3	2,347
1907	50	13,093	42	10,256
1914	27	15,986	33	17,904
1916	12	6,819	17	7,867
1917*	57	11,927	40	10,725

* The last statistics available.

Since Mr. Longyear sold his settlement to a Norwegian company, the other flags are represented only by a few units.

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[14] It takes the place of the former English mining settlement of Advent City, which no longer exists.

In 1917 the general commerce between Norway and Spitsbergen attained its highest figure up to that time, $1,240,000; in 1918 it was probably much higher, owing to the increase of coal exports.

At Green Harbor the Norwegian Department of Telegraphs has erected a powerful wireless station communicating with a station at Ingö, near the North Cape of Norway, and at the Norwegian settlements of Longyear City and of Kings Bay and at the Swedish settlement in Braganza Bay secondary wireless stations are installed. A Norwegian postal service is established between Norway and Spitsbergen, with three post-offices, at Longyear City, Green Harbor, and Kings Bay. In 1918, from June to October, postal steamers made 26 voyages.[15] At the wireless station at Green Harbor a complete meteorological station is working whose observations are published in the *Jahrbuch des Norwegischen Meteorologischen Instituts.*

BEAR ISLAND

A Norwegian company has also occupied Bear Island (Beeren Eiland). Lying 108 nautical miles southwards from the South Cape of Spitsbergen, this island is not so cold as Spitsbergen. Its annual temperature is —4.3° C. instead of —9.7° C. at Green Harbor,[16] but the East Spitsbergen polar current, flowing westward, carries extensive drift ice all around the island. When the season is good, Bear Island is entirely ice-free for at least four months; in bad years the sea remains ice-strewn until July, but navigation is possible before that time.

At Bear Island coal occurs in the Devonian and Culm strata. Since 1916 the building of a settlement and installations for the working of coal deposits have been under way; so far the exports have been small. Eighty men wintered this year on the spot.

PREDOMINANCE OF NORWEGIANS IN SPITSBERGEN NAVIGATION

The Norwegians have also had the largest share in the industrial development of Spitsbergen. Besides this, their acquaintance with the ice conditions for more than a century has, in a way, given them the monopoly of navigation in this archipelago, and nearly all the expeditions that have visited this Arctic land have engaged Norwegians as ice masters, frequently

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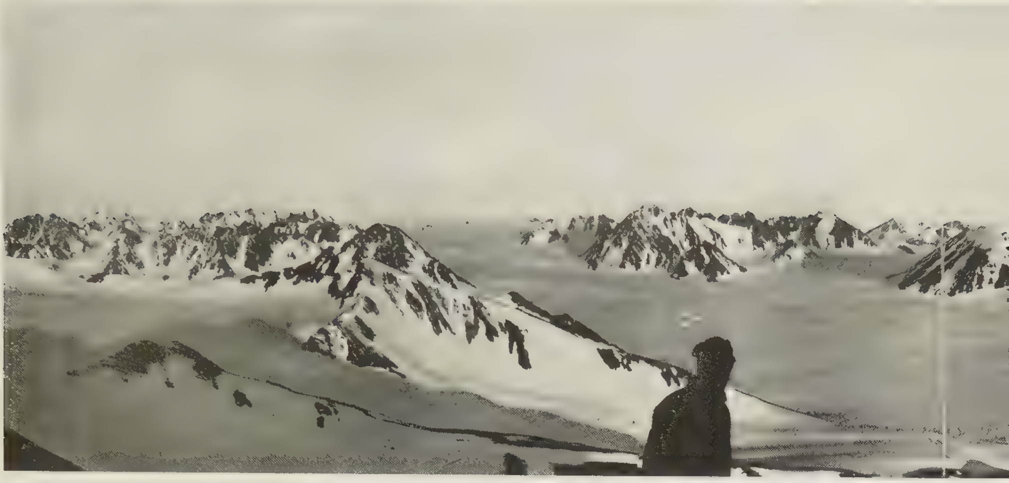
[15] During the fiscal year 1917-1918 the Green Harbor station received 2,041 telegrams and dispatched 3,323. It has intercepted 3,317 telegrams from other European and from American stations. In 1918, 10,322 letters, newspapers, and parcels were sent from Norway to Spitsbergen and 5,649 from Spitsbergen to Norway.

[16] Only three years of observations at Bear Island (1865-1866, 1910-1911, 1916-1917), seven years at Green Harbor:

MONTHLY MEAN TEMPERATURE (C.) AT BEAR ISLAND AND AT GREEN HARBOR*

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bear Island	—10°.5	—12°	—11°.2	—8°.7	—3°.6	+2°	+4°.2	+4°.5	+1°.5	—2°.3	—6°.4	—8°.6
Green Harbor	—20°.8	—22°.9	—21°.5	—14°.7	—6°.8	+1°.3	+4°.4	+3°.9	—0°.7	—6°.8	—14°.3	—17°.2

* Based on Adolf Hoel, A. Kvalheim, Claus Schive, med bidrag af Gabriel Smith: Björnöya, Christiania, 1918. [Published for private circulation only.]



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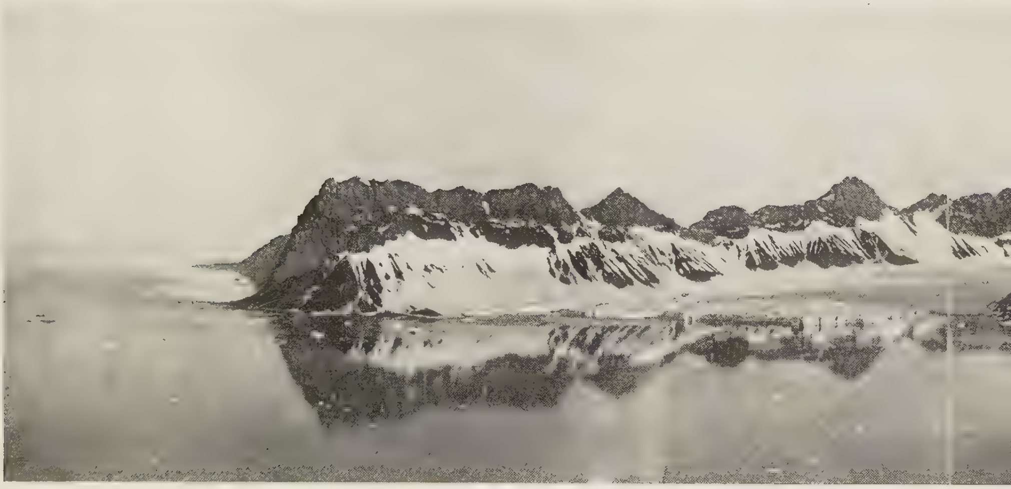
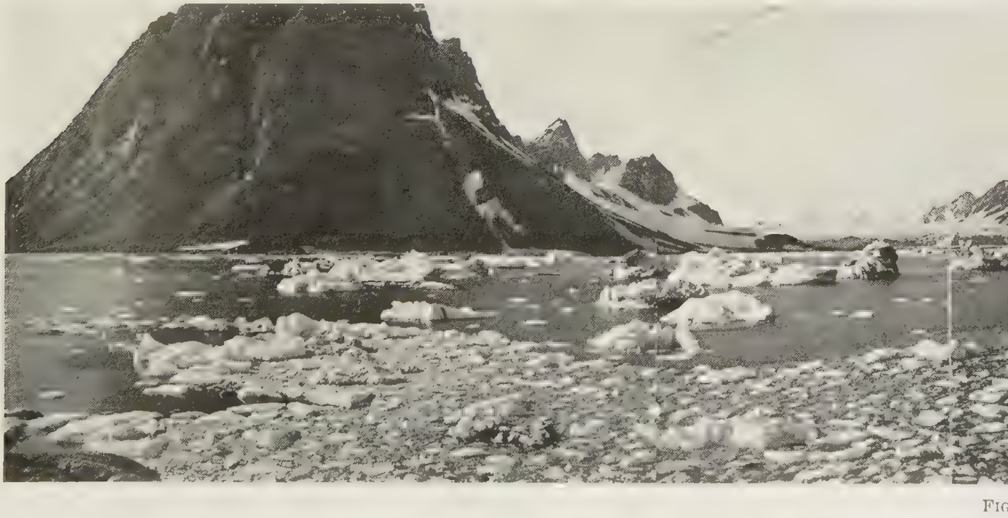


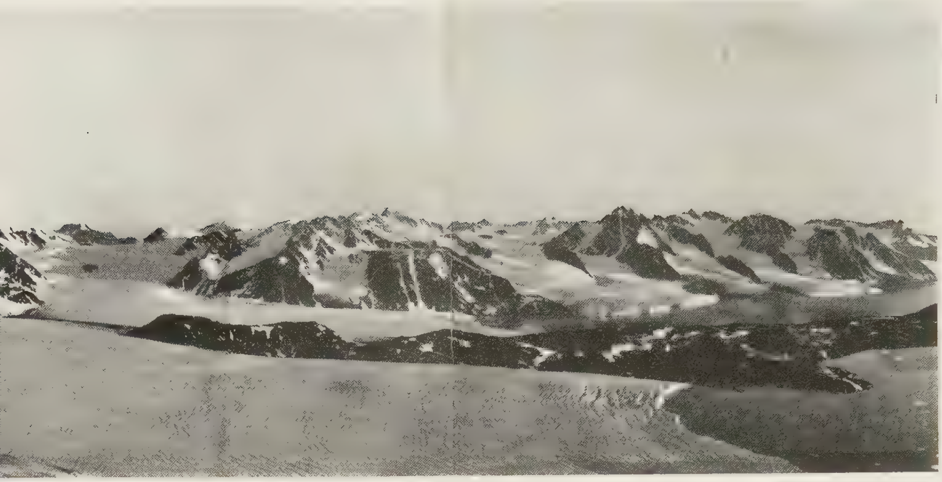
FIG.

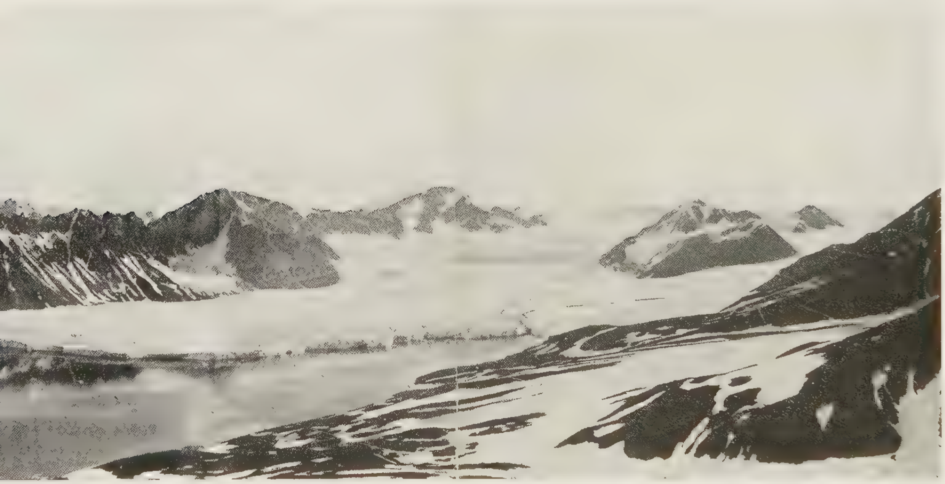


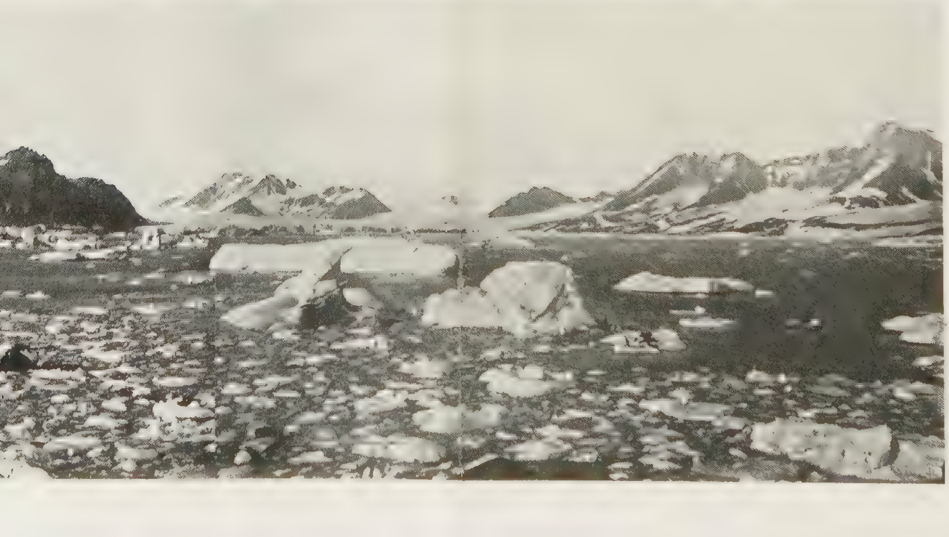
FIG

FIG. 13—Panorama from Ben Nevis, a summit 913 meters high southeast of Red Bay, northern West Spitsberg which ends in Red Bay (on the right). For locations see map referred to in footnote 4, first item. (Photo by C

FIG. 14—Panorama of Horn Sound, southern West Spitsbergen, taken from the ridge between Bürger Bay and







e view, which extends from south to northwest, shows practically the whole extent of the Grand Glacier,
Gunnar Isachsen, August 14, 1909.)

Bay. (Photo by Professor Adolph Hoel, 1918.)

even entirely Norwegian crews. Thus, if the Norwegian Government should forbid its nationals to pilot foreign ships to Spitsbergen, nearly all maritime traffic between these islands and other lands than Norway would cease or become very dangerous.

Political History

Ancient Claims and Disputes

Spitsbergen is not a "*terra nullius*," as it has been asserted. History establishes its rightful position.

At the end of the seventeenth century and for a long time afterwards Greenland was supposed to stretch northeastward and rejoin northern Russia by way of the Arctic Ocean. Barents himself and all his contemporaries were of the opinion that the land which he had discovered was part of a group of islands off the eastern coast of Greenland, and in this belief Spitsbergen was generally named Greenland until the beginning of the nineteenth century. Greenland belonging to the then united Norwegian and Danish crown, the King of Norway and Denmark accordingly claimed the ownership of Spitsbergen. This claim was also based on his generally accepted overlordship of the Arctic Ocean north and west of Europe, consequently of all the islands it contains wherever they might be and by whomsoever discovered.

In 1610 a number of whales in the western fiords of Spitsbergen having been seen by Jonas Poole, the news spread rapidly, and soon after numerous British, Dutch, French, Danish, and Hanseatic whalers arrived at Spitsbergen. Among all these competitors troubles and disputes arose; even sea fights were not infrequent. The King of Norway and Denmark, Christian IV, protested against these incursions of his domain, and long diplomatic negotiations on the whale fishery and on the overlordship of Spitsbergen opened between the Norwegian-Danish monarch and the King of England, the States General of the Netherlands, the King of France, the Hanseatic cities, and the King of Sweden. These polar islands were the occasion of the first colonial conflict among European nations.

Norwegian Claims

The King of England, James I, never expressly acknowledged the claim of Norway-Denmark regarding the sovereignty of Spitsbergen. Nevertheless in 1614 he offered to pay a rent to the Danish King, provided that English subjects should be granted a monopoly of the whale fishery in these islands together with the Norwegians and the Danes. Later on he suggested to Christian IV that he should sell him his right to "Greenland," that is Spitsbergen. The diplomatic transactions with England ended in 1621 by an agreement giving equal rights to English and Norwegian-Danish whalers in Spitsbergen. On the other hand, in 1632 the overlordship of the King of Norway and Denmark was accepted by the States General; however, a century later, in 1741, this acceptance was questioned by the Dutch. In 1663, 1679, and 1692, France, Sweden, and the Hanseatic cities respectively recognized the sovereignty of the King of Norway and Denmark over these polar lands.

Why has Spitsbergen today been declared *terra nullius?* During the second part of the seventeenth century, whales having deserted the coastal waters of Spitsbergen, there was a cessation of the disputes regarding these islands. When two centuries later, in 1872, Spitsbergen again found a place in the minds of diplomats, the old transactions were totally forgotten, and the archipelago was proclaimed *terra nullius*. Only recently, in 1912, Dr. Arnold Raestad revived a knowledge of their history, basing his information on the state papers of Great Britain, Denmark, the Netherlands, and France.[17] Is there no such thing in regard to treaties as title by long possession? By inheritance of the Danish king's rights Norway possesses the sovereignty of the archipelago, but this sovereignty is not complete, not having been recognized by all the powers.

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[17] Arnold Raestad: Le Spitsberg dans l'histoire diplomatique (translated from the Norwegian by Charles Rabot), *La Géographie*, Vol. 25, 1912, pp. 335-354; Vol. 26, 1912, pp. 65-98. The Norwegian original, "Norges høihetsret over Spitsbergen i aeldre tid," Christiania, 1912, contains 47 original documents.

GEOGRAPHY AS AN AID TO STATECRAFT

An Appreciation of Mackinder's "Democratic Ideals and Reality"*

By FREDERICK J. TEGGART
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New ideas are never wholly welcome guests. We are all creatures of habit and shirk the discomfort of entertaining strangers whose language we do not quite understand. Ordinarily we prefer the modes of thought in which we have been brought up. Only in times of trouble and upheaval, when the familiar routine of our lives is broken into, are we really open to new suggestions. But at such times we become alarmed and clamor nervously for the prompt application of practical expedients. In emergencies men are impatient to act, "to do something," without undue consideration. In such circumstances men think new methods are likely to prove a waste of time. Yet this is just one of the great lessons of the war. To overcome difficulties, and to succeed, it is necessary to be on the alert for new ways of doing things; and it is necessary to try these new ways, even in face of a nearly victorious enemy.

Need of Scientific Method in the Study of Human Affairs

Mr. Mackinder, ex-director of the London School of Economics and Member of Parliament, proposes a new method for approaching political questions, and his views demand serious attention. Today, he says, all society is clay in our hands. We are trying to remold this clay with the aim of producing a new and more equitable ordering of the affairs of men. But, he insists, the vision of a beautiful object—whether a Grecian urn or a league of nations—is not all that the clay-molder requires. He must have technical knowledge. Today we know how to manufacture munitions; we do not know how to assist Russia in setting up a stable régime. We know how to build airplanes and submarines; we do not know how to meet the demands of labor and capital. In the present situation expedients will no longer serve our needs. We cannot restore the conditions that existed before the war. We cannot accept all the proposals that are being put forward. Yet we must go on. The clay must be reshaped. To do this, without inviting disaster, we must have knowledge; and we must acquire this knowledge, not in academic seclusion, but as we go.

What we need, and need urgently, is the application of scientific method to the problems of human relations. Mr. Mackinder is emphatic in saying that we cannot hope to safeguard our democratic ideals without a grasp of the realities of geography and economics. He himself, in this book, attempts to put science to work in the field of politics; he seeks to yoke learning to the plow of public service. It is true that he is not alone in this desire to have our political experimentation conducted in accordance with scientific principles. He stands out, however, as one who has the courage to enlist erudition as a guide to action.

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* H. J. Mackinder: Democratic Ideals and Reality: A Study in the Politics of Reconstruction, Henry Holt & Co., New York, 1919.

This is not the first time that men have endeavored to approach human problems in a scientific spirit. We have, of course, forgotten the effect of the Revolutionary and Napoleonic wars on Mr. Mackinder's predecessors. We have, for example, forgotten that it was the aim of Malthus "to investigate the causes that have hitherto impeded the progress of mankind towards happiness, and to examine the probability of the total or partial removal of these causes in future." Malthus was far from being a voice crying in the wilderness; he was a participant in a movement, unhappily premature, to apply the comparative method to the investigation of social difficulties. So, too, the realization of the unity of the Eurasian continent, which Mr. Mackinder considers a revolution in the thought of our time, is not new. Even his remarkable presentation is no finer demonstration of this unity than the "Tableaux historiques de l'Asie" which Julius Klaproth published in 1826.

It is essential that we should recall instances like these in order to realize the precariousness of intellectual advance. The eighteenth century initiated scientific inquiry into the phenomena of human activity. Had this aim been fostered we should not be groping in the darkness of today. As it turned out, the efforts of Englishmen and Frenchmen to reach a new basis of inquiry were set aside in favor of a return to conventionalized scholarship under Prussian leadership.

The new movement which Mr. Mackinder represents cannot achieve its aim without definite and purposive support. This support, to be continuous, must be developed through the instrumentality of the university. But in what immediate connection can this be effected?

Failure of History to Meet This Need

One might think that history would have taken the lead in the application of scientific method to humanistic study. The comparative method lends itself effectively to the study of institutions; and one would expect a world outlook in the study fathered by Herodotus. History, however, has not embraced the opportunity. For this failure there are obvious reasons. In the first place, humanistic study has never progressed far beyond the Renaissance activity (on a par with that of the Alexandrian librarians) of editing texts for publication, and history, in the nineteenth century, surrendered unconditionally to this tradition. Then again the outlook of the historian is narrowed by the materials with which he works, and his vision is restricted to the contents of documents written in languages he can understand. As a result the study of history has persistently maintained a Europocentric standpoint. It is only within a few years that the extension of "ancient history" to include Egypt and Mesopotamia has been accepted in university teaching, and, as yet, Farther Asia is wholly ignored. The study of history is carried on in narrow compartments of periods and countries. This rigid procedure renders impossible the comparison of human experience under different conditions, and without comparison scientific results cannot be attained.

Opportunity of Geography

History being thus tied down by its traditions, we are forced to look elsewhere for a foundation on which to base a scientific study of man. Fortunately geography is available, and it has striking advantages for the purpose. It is unhampered by limiting traditions. It has not hitherto been taught in the university and is therefore open to free development in response to needs. It has the great advantage of close affiliation with the developed science of geology and may be said to be on good terms with anthropology, archeology, and economics. By the force of its materials, it is committed to a world outlook. The historian having put aside the leadership of Herodotus to follow the precedent of Thucydides, it is now possible for the geographer to return to the older and wider vision. Mr. Mackinder has taken the initiative in showing how a knowledge of geography may be utilized in dealing with the practical problems of political life.

To Make the World Safe—

We propose to make the world safe for democracy—but how is this to be done? Not by setting up a league of nations based upon juridical conceptions and diplomatic compromises. International law failed wholly to avert the war. Law comes into play when wrongs have been committed; but it is helpless without the backing of force. It prescribes limitations; but an uncounted number of law-making and law-administering bodies is required to keep up with men's ingenuity in finding loopholes of escape. "In our great replanning of human society we must recognize that the skill and opportunity of the robber are prior facts to the law of robbery." So we must take up our problems today as men dealing with realities of growth and opportunity, not merely as lawyers defining rights and remedies.

Democracies are inspired by ideas, not ruled by force. At great moments men become conscious of vast ideals: ideals of liberty in 1789; of nationality in 1848; of world unity in 1917. Is tragedy also to follow in the wake of this latest vision? Is the disappointed idealist again to fall into the hands of a Napoleon or a Bismarck? The nemesis of democratic idealism is the rule of the organizer. Democracy aspires to enable every individual to live a full and self-respecting life; the organizer disciplines men in the interest of efficiency. The democrat thinks in terms of principles, the organizer plans constructions. He opposes strategy to ethics. The democrat, being uncertain how to proceed, experiments; the organizer, having a "ways and means" mind, seizes the moment of uncertainty, and turns it to account. For success, the organizer needs only a plan, but the democrat requires knowledge which is not yet available.

Mr. Mackinder's Proposal

Mr. Mackinder sets about getting this knowledge by asking the pertinent question: How is the world to be made safe for democracy? As a result of his investigations he makes specific recommendations. To create the conditions precedent to an effective league of nations, he says, we must see to it that Eastern Europe is divided into self-contained nations. It is a vital necessity, he holds, that there should be a tier of independent states between Germany and Russia. Practically, he thinks, the realization of our hopes for the future turns upon the restoration of Poland and Bohemia to a complete national existence. In point of fact, the states indicated have been authorized by the Peace Conference and are now in some sort of being. We may, therefore, pass over his recommendations for action to examine the considerations upon which these proposals are based.

The Menace in German Control of Russia

Briefly, Mr. Mackinder believes that these independent states are necessary because the greatest menace to democracy lies in the possibility of German control of the Russian territories. The Russian Empire occupies a strategical position which it is Mr. Mackinder's aim to point out. This he states in a formula which, at first sight, appears more or less cryptic: "Who rules East Europe," he says, "commands the Heartland. Who rules the Heartland commands the World-Island. Who rules the World-Island commands the World." Obviously this statement calls for explanation.

The "World-Island"

In Mr. Mackinder's view "the joint continent of Europe, Asia, and Africa is effectively, and not merely theoretically, an island"—the World-Island (Fig. 1). The entire argument of the book, however, represents the area in a quite different light. The "Old World" land mass is an island only in theory, for the Polar ice, grounded on its northern shore, makes circumnavigation impracticable, if not impossible. The continent is the World-Promontory, stretching southward from a vague, inaccessible, and uninhabited north. It is strategically the ultimate peninsula, free from the menace of attack from a wider land behind.

Island, continent, or promontory, this area is, and must ever remain, of controlling importance in the affairs of men. True, it occupies only one-sixth of the surface of the globe, but it holds (with its adjacent islands) fifteen-sixteenths of the world's population. No development of other lands in the future is likely, Mr. Mackinder thinks, to affect materially this proportion. Within the continent, again, four-fifths of the inhabitants live in two regions (the European Coast Land and the Monsoon Coast Land, or "Indies") which together measure only one-fifth of its area.

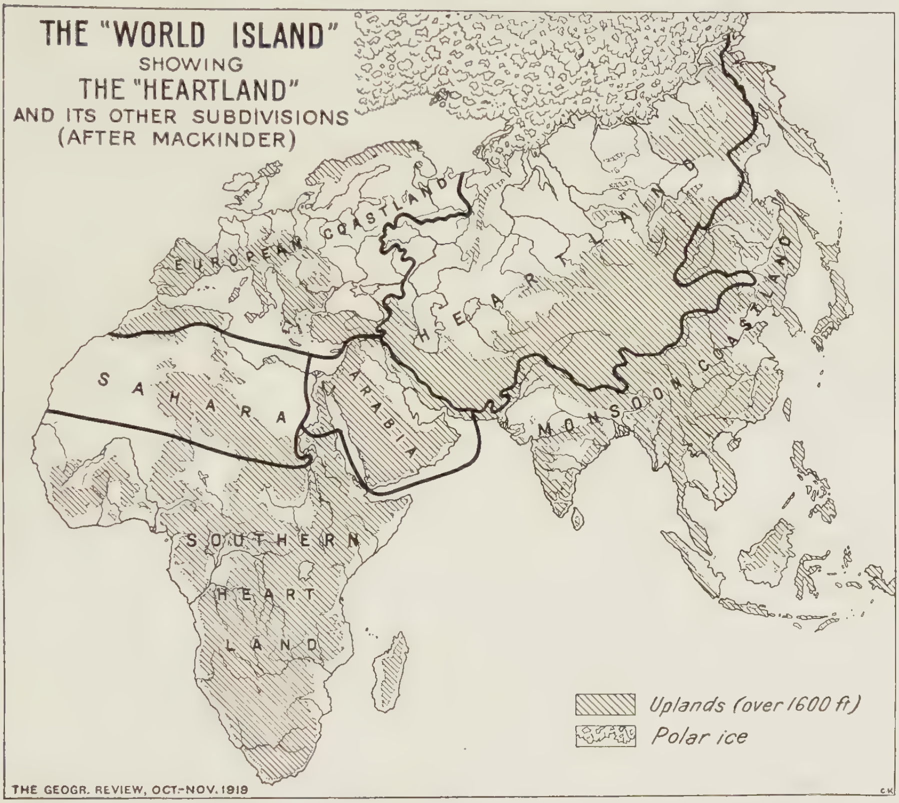

FIG. 1—The "World-Island" showing the "Heartland" and its subdivisions (adapted from Mackinder, Figs. 15 and 16). Scale, 1:150,000,000. The World-Island is an island only in theory, for the Polar ice makes its northern shores inaccessible and, from the standpoint of human development, turns it into a "World-Promontory."

UNEVEN DISTRIBUTION OF POPULATION

The uneven distribution of population thus indicated suggests an intricate problem which Vidal de la Blache was considering in the *Annales de Géographie* (1917-1918) at the time of his death. Mr. Mackinder, however, only goes so far as to point out that the populous "coast lands" of the East and West resemble each other in having numerous rivers navigable continuously from the ocean and in having a widespread rainfall on the plains as well as on the mountains. They are fertile and accessible from the ocean, in contrast with other lands which are sparsely populated, scantily supplied with rain, and inaccessible by water.

Of these other regions the most obvious is the Sahara, stretching from the Atlantic to the Nile Valley. It forms an unbroken boundary between the white and the black man. East of the Sahara lies Arabia, extending, as re-defined here, from the Nile to beyond the Euphrates, and from the Taurus to the Gulf of Aden (see Fig. 1). As a land it is half desert, half dry steppes. At this point one cannot but feel that the author has been tempted to oversimplify the facts in the desire to delimit the continent into a few major areas. Certainly the "Fertile Crescent" of the Near East cannot be accepted offhand as an integral part of Arabia. It has played its highly significant rôle in history, not as an arid region, but as one eminently productive and populous. The more effective way of regarding this remarkable strip is not as an oasis in the desert, but (in the manner of Hogarth, Breasted, and J. L. Myres) as a fertile zone exposed on all sides to invasion.

The "Heartland"

East of the Tigris, and beyond the rim of the Persian mountains, begins the vast region of continental and Arctic drainage which Mr. Mackinder denominates the "Heartland." In extent, it occupies about one-half of Asia and a quarter of Europe. But the Heartland has none of the sameness of the Sahara. It includes the great uplands of Iran and Mongolia; the deserts and river valleys of Turan; the inaccessible heights of Tibet; the amazing sweep of the grasslands and forests of Russia and Siberia. One feature alone permits of its classification as a unit: the rivers—and they are many and great—flow either into salt lakes, like the Caspian and Aral Seas, or into the frozen Arctic. Thus the Sahara, Arabia, and the Heartland together constitute a broad, curving belt extending across the continent from the Arctic to the Atlantic Ocean. Mr. Mackinder is at pains to emphasize the inaccessibility of these lands to ships, but the more immediate contrast is brought out by comparing the sparse, nomadic population of these regions with the dense, sedentary population of the "coast lands."

Mr. Mackinder's definition of the Heartland is a variable quantity. It starts from an acceptance, as a physiographic unit, of the distinctive area of internal or continental drainage. It ends in the strategical conception of a territory "to which, under modern conditions, sea power can be refused access." Now it is imperative that in this new study we should avoid confusion of thought. If new terms are to be invented, they should not be applied, at the very outset, to quite different entities. It is useless to capitalize the term "Heartland," if we do not give it a precise meaning.

The narrower meaning is the more acceptable. In Mr. Mackinder's book we are in the presence of a very large conception of the *modus operandi* of human history. This conception is not new, but only of late has it been rapidly gaining ground. One might give a long list of the men who have added significantly to our knowledge of the subject during the last fifteen years. The method of approach involves the theory of a center of dispersal of the human race in Asia. From this center have come the successive invasions which have overflowed the marginal lands—the Near East, India, China, Europe—in prehistoric, ancient, and medieval times (Fig. 2). If we take this center of dispersal as corresponding broadly with the area of continental drainage, we may see that the migratory movements have been from the infertile to the fertile regions, from the less to the more densely populated areas. It is far from unimportant that there has always been a disparity of man power on the part of the invaders of the coast lands.

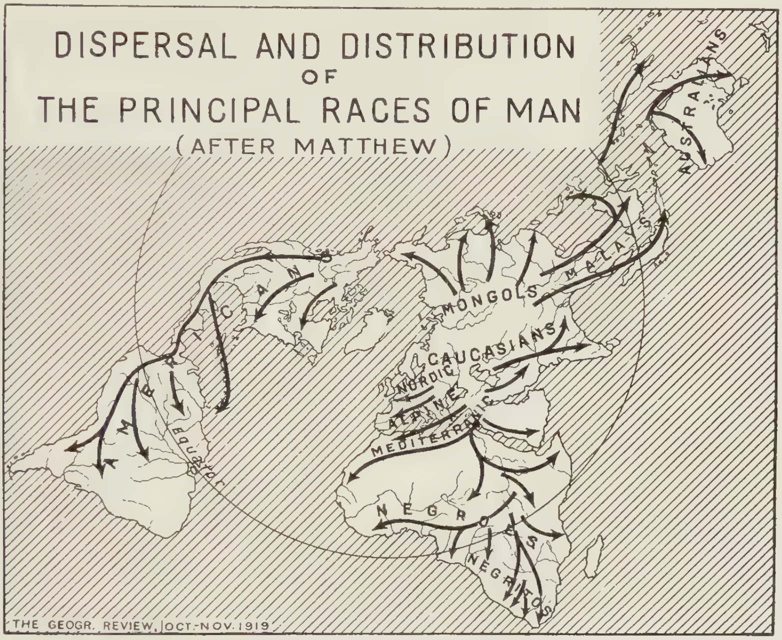

FIG. 2—Map of the world showing the dispersal and distribution of the principal races of man. Scale, 1:300,000,000. (Reproduced from Fig. 6 in W. D. Matthew: Climate and Evolution, *Annals New York Acad. of Sci.*, Vol. 24, 1914, pp. 171-318.)

MIGRATION FROM THE "HEARTLAND"

Migration from the Heartland to the marginal lands of the continent is not a theory, but a conspicuous fact. Furthermore, these movements have followed definite lines laid down by the abiding physical features of the globe. Thus the elevation of Tibet and the sink of the Caspian are obstacles which men have always been compelled to go around. China and India are protected against invasion by the most massive upland in the world. Consequently, the only entrances to these great lowlands are difficult routes and passes skirting the barrier. Westward, the situation is wholly different. The Caspian has deflected invasions to the south or north, into the lowlands of the Near East or across the grasslands into the European peninsula, but it has been no barrier. In contrast to China and India, the western lands lie open and exposed to attack by every wandering tribe. "The key," Mr. Mackinder says, "to some of the greater events of ancient history is to be found in the subjection of the peoples of the agricultural strip [of the Near East] now to this and now to that neighboring race of superior mobility. From the northeast, with all the vast depth of the Heartland behind them, the horsemen came down from the Iranian upland into Mesopotamia; from the south, with all the depth of Arabia behind them, the camel men advanced northeastward against Mesopotamia, northwestward against Syria, and westward against Egypt; from the northwest, whether across the peninsula of Asia Minor or directly to the Levantine shore, came the shipmen against Syria and Egypt, having behind them all the waterways of Europe" (p. 114; cf. Fig. 3). Similarly, at a later date, western Europe was subjected to the same pounding, and from the same agents—Huns, Avars, Magyars, Turks, from the Heartland; Saracens from the south; and sea-roving Norsemen from the northwest.

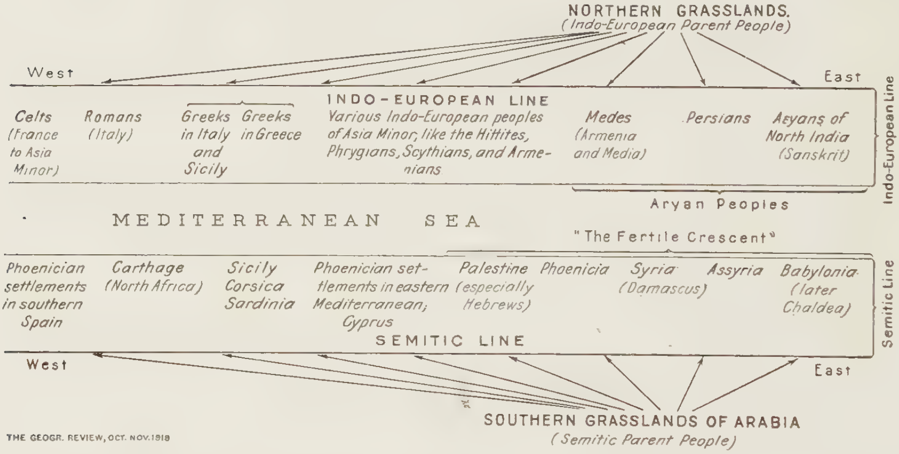
NORTHERN GRASSLANDS.
(Indo-European Parent People)
West
East
INDO-EUROPEAN LINE
Celts (France to Asia Minor)
Romans (Italy)
Greeks in Italy and Sicily
Greeks in Greece
Various Indo-European peoples of Asia Minor, like the Hittites, Phrygians, Scythians, and Armenians
Medes (Armenia and Media)
Persians
Aryans of North India (Sanskrit)
Indo-European Line
Aryan Peoples
MEDITERRANEAN SEA
"The Fertile Crescent"
Phoenician settlements in southern Spain
Carthage (North Africa)
Sicily Corsica Sardinia
Phoenician settlements in eastern Mediterranean; Cyprus
Palestine (especially Hebrews)
Phoenicia
Syria (Damascus)
Assyria
Babylonia (later Chaldea)
Semitic Line
SEMITIC LINE
West
East
SOUTHERN GRASSLANDS OF ARABIA
(Semitic Parent People)
THE GEOGR. REVIEW, OCT. NOV. 1918

FIG. 3—Diagram suggesting the two lines of Semitic and Indo-European dispersion. (Reproduced from Fig. 112 in J. H. Breasted: Ancient Times: A History of the Early World, Boston, 1916.)

"The actual lines along which these peoples lie are of course not straight. The lines sometimes overlie each other, as in Sicily, mentioned in both lines. Egypt, which geographically belongs in the southern line, has been omitted because it is not purely Semitic, although closely related to the Semites. Notice also that in the West the two races face each other for the most part across the Mediterranean; in the East they confront each other along the 'Fertile Crescent.' The Hittites, included above among the Indo-European peoples, became so in language, though evidently not originally so in blood."

SYSTEMS OF DEFENSE AGAINST INVASION FROM THE "HEARTLAND"

Here, then, we come to the point that lends to the study of migrations its transcendent importance. In default of natural defenses, the peoples of the Near East and of Europe have been compelled to protect themselves by setting up politico-military organizations. Such organizations have come into existence, in all cases, as a result of pressure; and, by way of contrast, unexposed areas have remained backward and unprogressive to the present day. It follows that an exhaustive study of the rise and development of political government is an essential prerequisite to an understanding of the modern world. It is quite useless to teach political theories when we do not comprehend political facts. To be of value, this study must be conducted on the basis of the comparative method. We must consider the experience of the East as well as of the West, for men everywhere have responded in similar ways to similar situations—the Romans also built walls to keep off enemies. So, we may see, the new study of geography leads at once and inevitably to an investigation of the foundations of modern civilization.

It is not, however, to be supposed that Mr. Mackinder has undertaken to deal with the whole of this most intricate matter, even in its primary geographical aspect. His aim, in the present book, is twofold. First, to show that the study of geography, carried on with due regard to scientific method, can be depended upon to throw light on practical political problems; second, to add directly to our knowledge by taking up one special phase of the general subject. He has not made a comparative study of the spread of political units throughout the world, but he has presented a most informing discussion of the conflict, ceaseless since the dawn of history, between sea power and land power.

THE STRATEGY OF EMPIRE: LAND POWER VERSUS SEA POWER

Mr. Mackinder's ambition, it is plain, has been to offer an examination of the strategy of empire, taking the whole world for a map. To be wholly successful in such an effort is probably impossible in the present generation. There is more than a trace of the persistent European bias in the author's mode of thought. That he is an Englishman, is apparent in the fact that he starts from "the seaman's point of view," though this actually narrows his outlook. That classical studies have established a major nucleus of ideas in his mind is evident when he takes the Greek seas, the Greek marginal civilization, and the Greek conquest by the semi-barbarian Macedonia as a pattern applicable throughout history.

With this approach, however, we are led to see a succession of empires, based upon sea power, each of which has been overthrown finally by a land attack. The success of land power, in each case, has come from a broadening of the field of operations and the seizure of the seaman's base of supplies. "The man power of the sea must be nourished by land fertility somewhere, and, other things being equal, that power will control the sea which is based on the greater resources'' (p. 45). The moral is obvious: this has been a war between the marginal and the continental powers. ''We have been fighting lately, in the close of the war, a straight duel between land power and sea power, and sea power has been laying siege to land power. We have conquered, but had Germany conquered she would have established her sea power on a wider base than any in history, and in fact on the widest possible base'' (p. 79).

The Case of Greece

At an early period in European history, we find a seafaring people settled round the shores of the Aegean ''sea chamber.'' The center of civilization in this pre-Greek world was the island of Crete; and Crete (like England) was the base of a relatively wide-extending sea power. The second phase of Aegean development shows this power overthrown by attack from the mainland. Horse-riding tribes of Hellenic speech, coming down from the north into the peninsula, subjugated the earlier inhabitants and, finally, from the peninsular base conquered Crete itself. At the next stage, these Greeks have, in turn, expanded east and west, colonizing the shores both of the Aegean and the Ionian Sea. They have set up a civilization on the marginal lands of three peninsulas—each one exposed to attack, and in the end to be attacked, from the rear (cf. Fig. 4). The first blow came from the Persian land power. After seizing the Greek cities on the eastern shores of the Aegean, Persia proceeded to reduce the central land base of Greek sea power by a vast turning movement by way of the Dardanelles and Thrace. The Persian victory did not lead to an actual

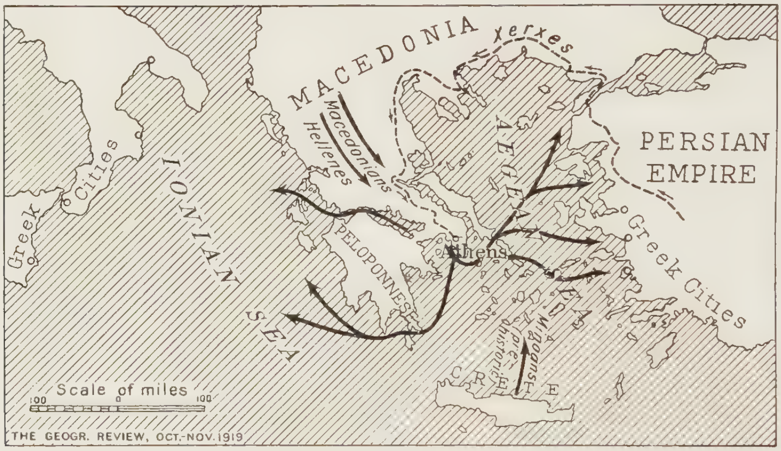

FIG. 4—The Greek seas, Aegean and Ionian, showing the Cretan insular sea base, and the Greek peninsular sea base; also the march of Xerxes to outflank the sea power of Athens. Scale, 1:13,600,000. (Reproduced from Mackinder, Fig. 3.)

conquest. This was reserved for Macedonia, the half-barbarian power seated in the root of the Greek peninsula. The Macedonian land power ended "the first cycle" of sea power, by seizing the land bases, not only of the Greeks, but of the Phoenicians and Egyptians as well. Alexander thus made of the Eastern Mediterranean a "closed sea," by which the author means that "without the protection of a navy, commerce moved securely over a water-way because all the shores were held by one and the same land power" (p. 48).

The Case of Rome

The development of the Western Mediterranean turned upon the contest between the rival sea powers of Rome and Carthage. In the First Punic War Rome "found herself" as a sea power, based upon the fertility of Latium. After it, she enlarged her land base by annexing peninsular Italy. In the Second Punic War Hannibal outflanked the Roman sea power by conducting an army into Italy. He repeated the strategy of Xerxes, with a like result. After the war, Rome extended her dominion over the coast lands of Spain and Gaul. In the Third Punic War Rome conquered Carthage and made of the Western Mediterranean a "closed sea."

The union of the eastern and western basins followed the Roman conquest of Macedonia, "Asia," and Egypt. The sea victory of Actium enabled her to make a closed sea of the Mediterranean. Rome brought under her dominion the entire circuit of Mediterranean lands, but from beginning to end of her career she remained a marginal power. Her empire fronted the Mediterranean, not the barbarian tribes of central Europe, or the Oriental powers of the Near East. Her frontiers must be regarded as demarking the limit of penetration from the Mediterranean coast. In Mr. Mackinder's words, "As the Rhine and Danube, defended by the legions, marked the extent of Roman penetration northward from the Mediterranean, so the upper Euphrates, where it flows from north to south before bending southeastward, marked the limit, defended by other legions, of their eastward penetration from the Mediterranean" (p. 114).

The Medieval Siege of Europe

As a consequence the fate of Rome, despite her more elaborate organization, was that of Greece. The later marginal civilization, though far more extensive than the earlier, was overrun by peoples from the deep interior of the World-Promontory. The situation at the downfall of the Roman Empire appears to us, of course, as exceedingly complex. This need not disguise the fact that the break-up was due to invasion from the Heartland and Arabia, and this not once, but many times in rapid succession; and not by one, but by every possible avenue of approach. The outcome of these invasions was what Mr. Mackinder calls "the medieval siege of Europe" (p. 61). Land power had reduced the marginal sea power to its last foothold in the western end of the European peninsula.

Here it would seem that a pardonable eagerness to reach that point in the narrative at which Western Europe turned the tables on her invaders has led Mr. Mackinder to neglect considerations of vital importance for his own argument.

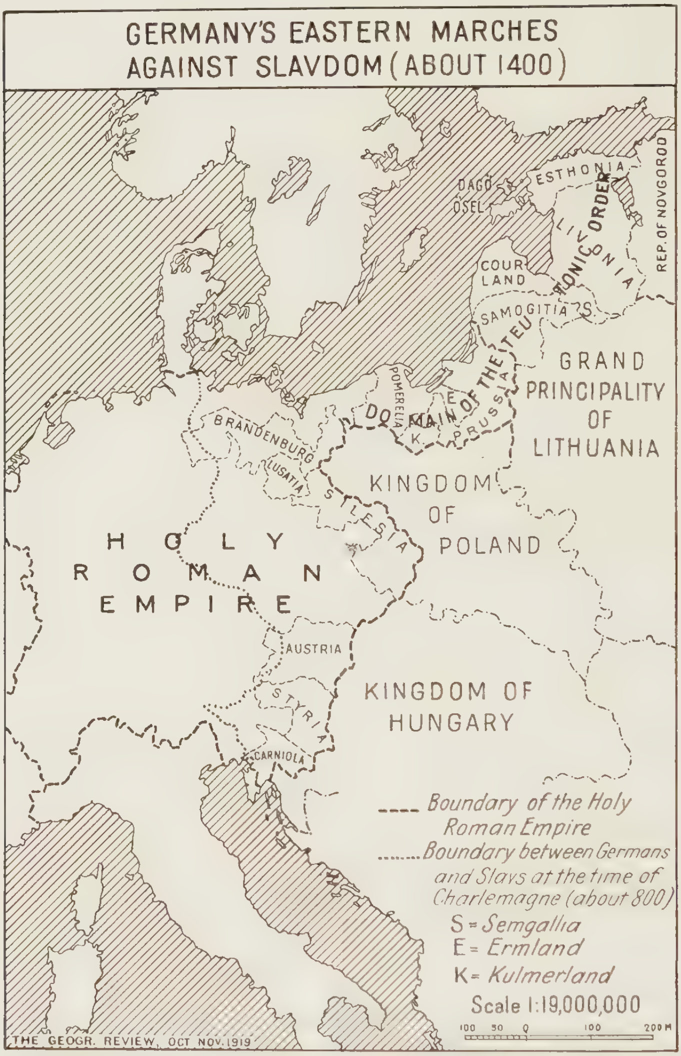
GERMANY'S EASTERN MARCHES AGAINST SLAVDOM (ABOUT 1400)
DAGO
ÖSEL
ESTHONIA
COURLAND
LIVONIA
DOMAIN OF THE TEUTONIC ORDER
REP. OF NOVGOROD
SAMOGITIA
S
GRAND PRINCIPALITY OF LITHUANIA
POMERELIA
E
K
PRUSSIA
BRANDENBURG
LUSATIA
SILESIA
KINGDOM OF POLAND
HOLY ROMAN EMPIRE
AUSTRIA
STYRIA
CARNIOLA
KINGDOM OF HUNGARY
---- Boundary of the Holy Roman Empire
........Boundary between Germans and Slavs at the time of Charlemagne (about 800)
S = Semgallia
E = Ermland
K = Kulmerland
Scale 1:19,000,000
100 50 0 100 200 M
THE GEOGR. REVIEW, OCT NOV. 1919

FIG. 5—Map showing the German *Marken* against Slavdom at the beginning of the fifteenth century. Scale, 1:16,000,000. Based on F. W. Putzger's "Historischer Schul-Atlas zur alten, mittleren, und neuen Geschichte," 41st edition, Leipzig, 1918, Pls. 15a, 17b, 18a, 18, 19b, and G. Droysen's "Allgemeiner Historischer Hand-Atlas," Leipzig, 1886, Pls. 71 and 30-31 inset.

The Defense of Western Europe

Let us keep steadily in mind that the Heartland and Arabia laid siege to Europe. "Only to the southeast were there practicable oasis routes leading to the outer world; but these were closed, more or less completely, from the seventh to the nineteenth century, by the Arabs and the Turks" (p. 62). Let us understand, too, that the seamen of Europe broke the siege

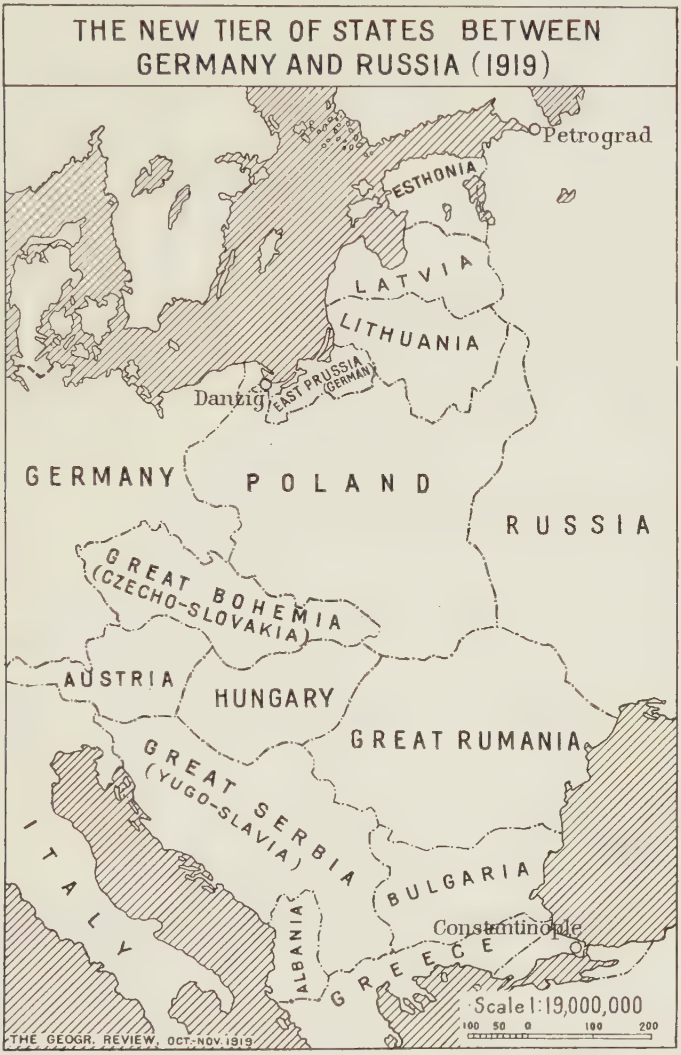

Fig. 6—Map showing the new tier of states between Germany and Russia. Scale, 1:16,000,000. Based on a map prepared by the American Geographical Society for the Committee on Public Information, showing the new boundaries in Europe as recommended to the Supreme Council of the peace conference. (See also Mackinder, Fig. 31.) None of the new states is at present completely defined except Austria; the map is only intended to show the probable configuration.

in characteristic fashion, ''once the Portuguese had found the ocean way into the Indian seas.'' ''Europe had taken its foes in rear; it had sailed round to the rear of the land, just as Xerxes, Alexander, Hannibal, and the Crusaders had marched round to the rear of the sea'' (p. 66). The view is illuminating, but, as presented by Mr. Mackinder, diverts attention from the means adopted for the defense of Western Europe against invasion. The fact is that, instead of building walls, medieval Europe adopted the alternative method of setting up military organizations on exposed borders. In central Europe, therefore, there was erected a line of *Marken* extending from the Baltic to the Adriatic Sea (Fig. 5). These defensive units existed in 1914, in the consolidated form of Germany and Austria.

The New Menace of Russia

It is, then, quite out of keeping with the historical background to seek for parallels ''between the half-Greek Macedonians and the half-Latin Germans'' (p. 61). The real Macedonia to our marginal civilization is the semi-barbarian power situated at the root of the European peninsula, the power known to us as Russia. The parallel was complete in 1914, whatever it may appear to be today. Mr. Mackinder strikes this keynote when he says:

> The map reveals at once the essential strategic aspects of the rivalry between Russia and Britain during the nineteenth century. [Britain did what she liked on the ocean.] Russia, in command of nearly the whole of the Heartland, was knocking at the landward gates of the Indies. Britain, on the other hand, was knocking at the sea gates of China and advancing inland from the sea gates of India to meet the menace from the northwest. Russian rule in the Heartland was based on her man power in East Europe and was carried to the gates of the Indies by the mobility of the Cossack cavalry. British power along the sea frontage of the Indies was based on the man power of the distant islands in West Europe and was made available in the East by the mobility of British ships'' (p. 165).

We misunderstand the situation when we call the Germans ''Huns'' and identify them with the invaders from the East. Germany and Austria constitute the system of defense, set up by Western Europe, against those invaders. It is true that the system was temporarily forgotten while the marginal powers to the West (like later Greeks) were struggling among themselves for colonial dominions and while Russia (the later Macedonia) was consolidating her power in Europe and reaching out to the Pacific. The era of extensive movement may be said to have closed when Russia abandoned her foothold on the American continent and turned her attention to Constantinople and India. Meanwhile, the Germans had been studying history and rediscovering the significance of their geographical position.

In the second half of the nineteenth century the Russian Czardom threatened all the marginal lands, and the Germans of Prussia and Austria awoke, as France and England had long before, to the peril of the situation.

They "determined," as Mr. Mackinder puts it, "to subdue the Slavs" (p. 137). What followed was "the *volte-face* of 1895, when was concluded the incongruous Franco-Russian alliance between democracy and despotism" (p. 161). "Russia allied herself with France against the Germans" (p. 162).

Relation of Germany and Austria to Western Europe

It must be evident to any one not blinded by recent events that, in the opposition to the power of the Heartland, the interests of the Western powers (England, France, and Germany) were identical. In actively opposing the Russian menace to the marginal lands, Germany and Austria were carrying out, for good or ill, the historic mission which Western Europe had entrusted to them. Germany is an integral part—the defensive frontier—of Western Europe. If her politico-military organization is a menace, it is the logical product of Western ideas.

The beginning of our present troubles goes back to the break-up of Europe at the close of the Middle Ages. Freed for a time from the Eastern pressure, Europe fell apart into a number of relatively smaller states, pursuing independent territorial aims. The late William T. Stead, in a moment of illumination, advocated the establishment of "The United States of Europe." Had such an organization been effected in the eighties, we should not have had the recent exhibit of Western Europe accepting an alliance with the Heartland enemy to destroy its own system of defense against that power. The war has not been "a straight duel between land power and sea power"; it has been another case of the internecine strife of Athens and Sparta.

Mr. Mackinder is of the opinion that Germany failed by reason of uncertainty of aim—"she fought on two fronts without fully making up her mind on which front she meant to win" (p. 191). But Germany failed, in reality, because she did not identify her cause as the cause of the marginal lands against the Heartland and the remoter East. She failed strategically because her leaders (like Napoleon) neglected to learn from Alexander that any advance into the Heartland must, of necessity, be preceded by a consolidation of the marginal sea power and the establishment of a closed sea.

The New Defense of Western Europe

The essential correctness of this view is shown in Mr. Mackinder's own recommendations. His proposal, in short, is that, having destroyed the old defensive units, we must forthwith proceed to erect a new tier of politico-military organizations between the Baltic and the Black Sea (Fig. 6). Any such system as that proposed is foredoomed to failure so long as Germany is not made to identify herself, in spirit and in interest, with Western Europe. To leave the new states between the upper and nether millstones is to invite destruction. And who, indeed, will guarantee that the Slavic *Marken* will be less disposed to militarist ambitions than the Teutonic? For a long time to come the ''League of Nations'' will be forced to maintain these new states on a war footing against the Russian peril. Who will guarantee that one or more of these states may not be disposed to march westward? May we not be whetting the edge of the Eastern sword to our own undoing?

The Safety of Democracy Demands Knowledge

Only the greatest wisdom can possibly avert the evils that threaten our common Western civilization. ''The one hope of the future is that even democracy may learn to take longer views'' (p. 180)—by acquiring knowledge. The patchwork of diplomatic compromises that we call peace is no sufficient guarantee of the future. Russia, as in a mist, lies portentous in the background. The European peninsula is visibly in ruins. The United States seems disposed only to abide within the fancied security of its western island. On England devolves the burden and responsibility of the hour. She is fortunate in having men of Mr. Mackinder's vision.

THE LAST EXPLORATION OF LIEUTENANT MARQUES DE SOUZA: DIARY OF A JOURNEY ON THE ANANÁZ RIVER, BRAZIL*

PART I†

The discovery of the Rio Theodoro by Colonel Roosevelt in 1914 provided the key to a large region drained by that river and its tributary streams. It was to be expected that thereafter one after another of the tributaries would be traced to the main stream. The first of these tributaries to be explored was the Ananáz,[1] *or Pineapple, River. The work was carried out, under the direction of Colonel Rondon, by Lieutenant Marques de Souza, who was attacked and killed by the Indians. One of the* camaradas *who had been out hunting returned to camp after the tragedy and discovered the Indians before they saw him. After watching for seven hours until they left camp, he obtained de Souza's diary, an invaluable record, descended the bank of the Ananáz River to the main stream, and after twenty-four days' voyage down this river found the first rubber gatherer. After a journey of twenty-two days farther down stream, all of this on foot, he finally managed to secure a canoe.*

The above facts are related in a letter from Colonel Roosevelt to the Director of the American Geographical Society under date of December 21, 1915, and were published in the January, 1916, number of the Geographical Review *(p. 50). Later on, Kermit Roosevelt, who accompanied his father on the exploration of the Rio Theodoro, obtained a copy of the diary of Lieutenant de Souza and at the request of Colonel Roosevelt loaned the diary to the Society for translation and publication in the* Review. *The Councilors of the Society and the Editors have a double pleasure in publishing this diary; first, because it was Colonel Roosevelt's wish to have it published and, second, because it is a record of an important piece of exploration in the heart of South America. The tragic death of its author leaves the record incomplete as to the character of the whole course of the Ananáz River. The diary is prefaced by a summary introduction which appeared when the diary was first published, in the September 13, 1915, issue and subsequent issues of the* Jornal do Commercio *of Rio de Janeiro.*[2]

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* Translated from the Portuguese and published in the *Geographical Review* at the request of the late Colonel Theodore Roosevelt.

† Part II, completing the diary, will appear in the next issue of the *Review.*

[1] Where referred to previously in the *Review* the name of the river has been spelled Ananás. The form Ananáz seems to be preferable, however; it is this form that Colonel Rondon uses in the book cited below.

[2] In the official account of his activities as chief of the Brazilian Telegraphic Commission, Colonel Rondon, in view of this circumstance, makes only brief mention of Lieutenant de Souza's exploration of the Ananáz River and refers the reader to the published diary in the *Jornal do Commercio* (Conferencias

INTRODUCTION TO THE DIARY

We are enabled today to reconstruct, with all details, the scenes of the morning of May 29, 1915, on the banks of the Ananáz River, the day on which Lieutenant Marques de Souza of the Rondon Commission, charged with the making of a survey of that river, fell a victim to the arrows of the Arára Indians.

At the head of a division of ten men Lieutenant de Souza had started on February 16 the exploration of the Ananáz, and through his diary our readers will become acquainted with the adventures and incidents of this laborious and daring journey, carried out in the midst of almost insuperable dangers, in which three shipwrecks were experienced in little more than three months of incessant labors.

We shall describe the scenes of May 29 with the use of the declaration made by the survivors of this tragic morning in those distant parts of the Matto Grosso wilderness.

On the preceding day the commander had put to shore and had set up his forty-third encampment. He was forced to do this because at the falls nearby. . . two of the canoes of the expedition had been broken and wrecked, and, as this left only one, it became necessary to stop and make more.

Near the right bank of the river there are two islands. The commander selected the larger one, with magnificent shade trees, for his camp . . . . The men had been properly distributed to meet the necessities of the day, some making canoes, some hunting, some fishing, and some gathering Brazil nuts. Marques de Souza had remained on the island and directed the work of the four men constructing canoes. The gigantic silent forest around seemed tranquil and, indeed, uninhabited. Still, hard by the camp, and only a few meters away, a naked group of unknown Indians were looking on and observing everything, eluding even the scent of the dog, awakening not the least suspicion of their presence nor making the slightest noise that might betray them.

The expedition, as we have already said, now had at their disposal only one canoe, and this the two men sent to hunt had taken to the far side. They had taken with them also the only two firearms, of the small number remaining with the division in condition to be used. The whole party of daring explorers were now dispersed.

Suddenly, a first arrow cuts the air, then another, and another. Both on the water side and the land side the men perceived they were being

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realizadas pelo Coronel Candido Mariano da Silva Rondon, Chefe da Commissão, nos dias 5, 7 e 9 de Outubro de 1915 no Theatro Phenix do Rio de Janeiro e referentes a trabalhos executados sob sua chefia pela Expedição Scientifica Roosevelt-Rondon e pela Commissão Telegraphica, [*Commissão de Linhas Telegraphicas Estrategicas de Matto Grosso ao Amazonas Publ. No. 42*], Rio de Janeiro, 1916, pp. 202 and 205; or English version: Lectures Delivered by Colonel Candido Mariano da Silva Rondon, chief of the commission, on the 5th, 7th, and 9th of October, 1915, at the Phenix Theatre of Rio de Janeiro on the Roosevelt-Rondon Scientific Expedition and the Telegraph Line Commission, translated by R. G. Reidy and Ed. Murray, *Commissão de Linhas Telegraphicas Estrategicas de Matto-Grosso ao Amazonas Publ. No. 43*, Rio de Janeiro, 1916, pp. 237-238).

attacked by the savage Aráras. Seizing the only available firearm, Marques de Souza, bravely but in desperation, shoots into the air . . . . He attempts to shoot the second time, and the arm misses fire. The Indians gather courage and advance, shooting arrows in every direction. Betrayed by his rifle, the officer still tries a last resort. Spreading his arms in an attitude of friendliness, he exclaims: "Don't shoot me!" His heroic figure, however, and his generous gestures were not enough to overcome or move these sons of the land, who here found an opportunity to avenge the persecutions of which they had unscrupulously been made victims, for many years, in the rubber groves. Marques de Souza received two arrow wounds in his open breast and one in his abdomen. Seeing Tertuliano Ribeiro de Carvalho, the canoe maker, already dead at his feet and a companion very badly wounded, the officer throws himself into the water and, with his men, attempts to swim to the side where the canoe is. Becoming exhausted, he sinks out of sight in the strong current. And thus ends the life of this brave officer, who was one of the most worthy members of the Rondon Commission.

With the death of their leader and of another of their number, whose body was taken into the canoe just as it was sinking, with another boatman wounded four times by arrows, the men, now left to themselves and without a commanding head, are seized by a panic . . . . Abandoning the two dead bodies and the two companions who had been assigned to hunting and had buried themselves in the depths of the forest, they rowed away down the stream. One of the hunters, by a fortunate coincidence, happened to be near the bank of the river and, hearing the noise of the passing boat, threw himself into the water and joined those who fled. Of these, two were entirely without clothes. The other hunter remained there ignorant of what had happened. When the sun was high he turned his steps toward the camp, carrying with him the game he had killed. Coming along and peeping around, as professional hunters do, on drawing near the camp he heard an unusual murmur of voices, which he did not take to be the voices of his companions. He drew near with quiet and caution. Crouching down in the hollow of a rock, he noted that the camp where he expected to find his leader and comrades was now held by a large number of Indians. He could see them take the dead watchdog and wrap it in the rubber coat of the commander. He observed that they broke and threw into the water the engineering instruments with which the survey of the river had been made. From this hiding place he noted all that went on and remained in this dangerous and critical position till the rays of the evening sun softened the western horizon, unable to do anything on account of the invincible numerical superiority of the enemy.

The hunter remained in this situation through seven consecutive hours. Near nightfall the Indians, throwing themselves into the river, swam to the other side to go to their *malócas.* Then the spy got up and made his way toward the camp, where he examined the broken remnants that had been abandoned and found among them the diary of Lieutenant Marques de Souza, a valuable relic, the original of which the Rondon Commission has delivered, on Saturday, to the family of the lamented standard bearer.

We have obtained a copy of this document, the first pages of which we offer today to the readers of the *Jornal do Commercio.*

Marques de Souza would write in a notebook, day after day, his impressions and the results of his explorations as they were made. These notes were made without any special attention to style, many times on the prow of a canoe, and they reveal, in their simplicity, the worthy officer's nobility of soul, his untiring energy, undaunted courage, and unlimited zeal for the work entrusted to him. Together with the diary there were found also the record book of the men and other small objects.

On the morrow, having given up all hope of finding his companions, the hunter decided to depart. Following the river's edge, stopping only at night, he succeeded in escaping, bringing with him the objects he had gathered up. On the 31st he came to a sandy beach and saw on it the body of Marques de Souza. He then verified the three wounds which we referred to above. With a fragment of a broken Indian pot and with an extinguished torch which he found near the body, this member of the expedition dug a grave in the sand, and buried there the body of his unlucky chief.

This *caboclo,* João Pereira da Cruz, a native of Piauhy, left without a companion, condemned to make his way across the great unknown, counting on himself alone for food, for sleep, for defense, presents a picture of deep interest to us all. For twenty-four days he traveled, making as long stretches as his insufficient food and his fatigue would permit. At the end of this time he came up with the first ranch of *seringueiros.* But it was not possible to rest there, and so for twenty-two more days he had to trudge forward. At the end of these forty-six days he met with somebody on the river who, having pity on him, took him down the river in his dugout till they caught up with his ungrateful companions who had gone on ahead. With them he arrived in Manáos nearly two months after the tragic event.

THE DIARY

THE START

February 16, 1915. We rose at 4:30 and soon after we took our *guarana* (a native beverage). At 5 o'clock Candido served us with a porridge of chocolate and rolled oats. The Colonel gave me his last directions, and at 6 o'clock in the morning he was traveling in the direction of Vilhena.[3] At this hour pack mules arrived from Tres Buritys[3], bringing the rest of the baggage and my dog Dick, who remained there. The Colonel left me Baroneza, on condition I should deliver her, after the expedition, in Calama.

February 17. Happily I have moved today the camp to the Ananáz River. Now, properly speaking, I shall begin my work. The pack mules, after camp had been moved, went on to Tres Buritys.

February 18. I have not yet begun my work. I sent for the canoes. There is a scarcity of large logs, so that it becomes necessary to deobstruct the river bed in order to make the first *ubá* (dugout canoe). Unfortunately I have to lie down all the time on account of my feet. I have endured it because I cannot get out from under the mosquito net, on account of the plague of bees, *piums, borrachudo* gnats, and such. What a martyrdom! . . . . (11.30 P. M.) I have slept little since we left Barão de Melgaço.[3] I am not able to sleep before 12 or 1 o'clock, and, even so, I wake up from time to time. I get into a terrible state of despair. I am eager to begin my work, in order to be through with it as soon as possible. There are pleasant moments in this wilderness life, but, by way of compensation, when times of bitterness and abhorrence come, one suffers more, much more, than in any other place. A minute of suffering seems like an hour. Maybe this is due to the absence of any person or friend who might afford consolation.

HOMESICKNESS

February 20. The men continue actively at work on the first *ubá,* and it is nearly ready. My homesickness presses harder and harder upon me. Heretofore when I thought of home and felt homesick, I would soon think of something else and divert my attention. I had always a friend to talk to, so that my thoughts would be occupied. Here in this far-away wilderness, this desert, without a companion with whom to exchange ideas, living in complete isolation and, worse still, prostrated in a hammock and unable to walk, with nothing to divert one's attention, time passes very heavily, and I spent it with my thoughts. It is at these lonely times that homesickness presses hardest upon me, longings for home, for my betrothed, for my friends.

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[3] Vilhena and Barão de Melgaço are stations on the telegraph line near the headwaters of the Ananáz River. Tres Buritys is a cattle ranch between the two stations. For locations see maps in *Geogr. Rev.*, Vol. 1, 1916, p. 171, and in Colonel Rondon's lectures, cited in footnote 2, Portuguese version, p. 253, English version, p. 269.

I am inclined to think this life of an explorer is more trying than I once believed. Still let it be what it may; I only hope to begin my work soon in order to get into a place inhabited by civilized people. Today is Saturday, and oh! how much I have thought of home!

February 21. Today is Sunday, and I have spent the whole time thinking of home. At 3 o'clock in the afternoon I resolved to do my first piece of work: I made calculations on the cross section of the river and the volume of water discharged.

The First Monument

February 22. The first canoe has been completed, and the work of constructing the first monument is also ended. We expect to set it up in the clearing in the *mangaba* grove tomorrow. The monument has the following inscription: "Rondon Commission. Monument No. 1. Campo do Mangabal. Moorings for the branch from Campos dos Palmares de Maria de Molina. Monument at the landing on the Ananáz River from which the exploring division descended this river. Lieutenant Marques de Souza. 2-22-1915."

February 23. 4 A. M. Today I begin to make a map of the road from the clearing in the *mangaba* grove to the landing at our encampment. What absolute silence prevails here! From time to time it is broken by the stirring of pots, in which Candido is preparing our breakfast, and by the mournful hoot of owls, which sounds like the hallooing of a person in distress.

February 24. Yesterday I made the survey of the clearing in the *mangaba* grove on the left bank of the Ananáz. It has an extension of —. They have already begun to work on the second canoe, and at midday today we begin the third, hoping to leave here on the same day that Colonel Rondon and Colonel Roosevelt started down the Rio da Dúvida last year.

February 25. The second canoe is ready. I have worked hard. On the 23rd I went to bed at 11 P. M. and got up at 2:30 in the morning to finish the first sheet of my map. Today I make the first observations with the aneroid barometer.

February 26. Unfortunately the cashew tree that we felled for the third canoe proved unserviceable, but another was found a good way below our mooring place. I think we shall leave here on March 1.

Survey of the River Begun

February 27. I began the survey of the river in the section farther down, where they are making the third canoe. At night I worked on the daily map sheet.

February 28. Not till now, at 11 P. M., when I was getting ready the papers for the men, had I noticed it was Sunday! The last boat is ready, and tomorrow, God willing, I shall begin the work.

March 1. At 6:30 o'clock I went up the Ananáz and made the survey of it, descending the river as far as Porto Novo, the first camp. I did not get as far as the bar of Ribeirão Anta,[4] as was the desire of Colonel Rondon, for the river was badly blocked up with trees and, as I was not able to walk, it was impossible to go by land.

AN INDIAN GARDEN PATCH

At 11 o'clock I moved the camp, but the place is very bad, ugly, and surrounded with *igapós*.[5]

I am not well.

March 2. What a terrible place this is! Damp, dirty, and surrounded by pools of stagnant water. Tomorrow I am going to move the camp farther down, for the men who are cleaning out the river told me of a good place. At 2 o'clock in the afternoon I went out with Candido, and we explored a beautiful little meadow where purple grass grows with wonderful exuberance. It is some 300 meters from where we are and 50 meters from the left bank of a creek, which I supposed to be the Lyra. It is a place where the Indians formerly had a garden patch, and we found there a weak stalk of manioc.

This little meadow is located on the left bank of the Ananáz; it has the form of an ellipse, its greater axis measuring 350 meters and its lesser axis less than 100. Unfortunately my work has been very slow, for the river is completely blocked with trees that lie across it from bank to bank. And I am so eager to proceed rapidly in order to get home!

VESTIGES OF INDIAN OCCUPATION

March 3. Today, at 7 o'clock, I moved the camp to a place on the left bank of the river 15 meters high. It is in the midst of reeds and is surrounded by low forest. It appears to be the site of an old native village. There are several roads and a small wooden bridge at a clear landing place, and everywhere vestiges of former occupation.

March 4. Today was a day of hard work for me. I made the survey from Camp No. 2 to Camp No. 3, and from this to the place I have selected for my Camp No. 4, for I am counting on moving tomorrow very early in the morning. I am glad of the direction which the river seems to be taking, for it runs toward the east, that is it is going away from the

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[4] *Ribeirão*, a large tributary, as compared with *igarapé*, a small tributary (see legend on Map of Rio Roosevelt, 1:400,000, *Geogr. Journ.*, Feb., 1915).

[5] *Igapó*, a slough, "a temporary rivulet with no source" (glossary, English version of Colonel Rondon's lectures).

Roosevelt toward the watershed of the great Aripuanã. The outline of the daily work is nearly finished. Tomorrow I shall finish it.

We have no meat, and there is no fish or game. We are on simple soup and beans, rice, and *farinha* (manioc root grated, dried, and roasted).

CHARACTER OF THE RIVER

March 5. I moved the camp; this is Camp No. 5. The forest is grown up and has much undergrowth, but the land is sandy and dry. The river continues as above. It has received several *igarapés*,[6] but instead of getting broader it gets deeper and at places is very narrow. It has some very peculiar turns, and the guiding of the canoes is very difficult. Fortunately today the troublesome bees, the mosquitoes of a thousand kinds, the terrible *motucas,* and the persistent *beruanhas* did not molest us. Now at 6 P. M. it is raining very hard. How lonely I feel when the evenings are rainy! How often I think of home, my betrothed, and my friends!

March 6. At 7 A. M. I went down the river to look it over, as I usually do before making a survey, to the place where it receives two *igarapés* on the left and one, I think, on the right. You cannot be certain, for the land is all low.

PORTO DOS CANANÎS

I went as far as the foot bridge that the Nhambiquara Indians, a sub tribe of the Cananîs, use. To the left lie the Campos dos Palmares de Maria de Molina.[7] I searched there at the landing for a farewell message which Colonel Rondon had left for me some days ago, when he was exploring the Campos, but I did not find it. Surely the Indians must have taken charge of it. On arriving at the Porto dos Cananîs, a high place, I saw our boat without the men and supposed they had gone to where the Indians were. I was not mistaken. On calling twice, they came with two Indians and a child. Little of what the Indians said to me, in answer to questions I asked, did I understand.

INDIAN SAVAGERY

I only understood clearly, as on this point they were intelligible, that the river ran toward the east all along. If it be so, who knows but that I may be on the headwaters of the Canumã? I immediately thought of a fact that had saddened me deeply on the night of February 15, a fact narrated by Colonel Rondon when he came to my camp to say good-by. He told me that, while ascending the upper Gy-Paraná, a little below the old Arára (Macaw) Camp, he saw in a cashew canoe three Indians. Drawing near he noticed that all three were wounded. One of them, an old man, had two arrow wounds through his neck and another in his hand; there was a child with a wound in one hand and a boy with a wound in his breast. After hasty treatment to the wounded persons he went on his way and, on arriving at the old Arára Camp, stopped and went on land. On looking around he saw that in this place a terrible struggle had been carried on, a struggle in which some native Indians had fought with all their savage ferocity. On the ground were abundant vestiges of this sanguinary battle. The matted grass, the broken arrows, and the pools of blood revealed what had taken place there. It was horrible! . . .

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[6] See footnote 4.

[7] Site of the station José Bonifacio (see Colonel Rondon's lectures, English version, pp. 166-167).

He had been much impressed with this incident. On arriving at Pimenta Bueno he was able to learn the whole truth.

At the old Arára Camp there was a group of Indians who were descendants of the Tapys. Among them were Marupá, Avená, the squaw Inaiôp, an old man, and a child. Marupá and his young wife Inaiôp were liked by all. They were cheerful, playful, and very much united. Some time before Colonel Rondon had sent for the Kepikiri-uats to give them presents, as he always does with all Indians. They did not wish the meeting and preferred to make a light canoe of cashew bark and go down the river to wait for him. On arriving in front of the landing place, Porto das Aráras, they stopped and went ashore. Their object was to carry away the unlucky Inaiôp. In the bloody struggle that ensued the robust, but unfortunate, Marupá perished.

It rains every evening till late at night.

First Misfortune

March 9. This poor notebook of mine, which has been with me from Porto Alegre and since August, 1908, has been lost for two days. I am going to transcribe the notes I took on the 8th. Yesterday, when moving the camp to this place, I was about to tie up at Porto dos Indios, when my canoe struck a log and, owing to the strong current, upset, and I lost all my food, many small objects, and all my matches. Fortunately I saved the instruments. I have only eighty matches—all that I was able to get together from the men. I have already made arrangements to send João with an Indian to Tres Buritys to see if I can get, at least, one package.

In this my first misfortune I lost also the notes that I was making, my purse, little scissors, mirror, and field glasses, small articles, but indispensable on an expedition. Still, I thanked God I have saved the case containing the expedition papers; and my watch still runs in spite of the formidable bath it got. The Indians are constantly in our camp, with nothing to do, happy in the nomad life they lead. Even now a group of women is by my side, laughing and talking every moment. In them joy prevails, while in me, sadness.

My longings for my loved ones, the misfortune of yesterday, the absolute lack of game and fish as food for the men, the condition of the river, everywhere blocked with trees, and indeed a thousand little things, are the things that make me sad. I am eager to leave this region and reach another, where the woods and the river may furnish me some food.

SABANEZE INDIANS

March 11. The Indians did not come around yesterday, but instead they stole two axes from me, the best ones I had. On the 9th, for the second time, there came the most handsome Indians that I have seen in this region of the Nhambiquaras. I thought they were Sabanezes. They are of a light complexion, with a reddish skin; their bodies are shiny and they have beautiful muscles. My first concern was to take a photograph of them; but when I had set up the tripod and had placed the camera to set the focus, the men suddenly snatched up their bows and arrows, and the women their *baquités* filled with pineapples, and made away so quickly that I was not able to get even a snapshot. There remained in our Camp No. 4 only two Indians from the village a kilometer away. I succeeded in taking three snapshots of these without exciting their distrust. There, also, I met an Indian who was very old, but he was still strong and cheerful.

At 11 o'clock João arrived. He had gone to Tres Buritys and, as he did not find José Francisco there, went on to José Bonifacio. Happily he brought seventeen boxes of matches—enough for two months!

INDIANS FROM JOSÉ BONIFACIO

I set up the camp today on the left bank. It is our sixth camping place. I am glad to say the river is better. It is a little broader but very deep, and, in place of the thicket of bushes, we have cane. Solid earth is scarce. Everywhere the country is inundated. At 3 P. M. a group of Indians from the *malóca* (village) of Nanhila, near José Bonifacio, came. They had come with João as far as the village near our camp. I have been in our Camp No. 6 since 12:30 today. The position is high, but the woods are grown up with bushes and weeds. In the center is a clearing.

March 12. The group of Indians from José Bonifacio came in—Iceutê, Mainlindê, Camaindê, and two fine, lively boys. They are going on with João Perú to the open fields to look for cattle, for we are now living on *farinha* and rice. The Indians returned at 3:30, having done nothing. They spent the time in our tent imitating birds and animals with wonderful perfection. At 5:30 they went away to José Bonifacio.

March 13. We moved today to Camp No. 7, on the left bank of the river. At noon six men went out to the open field to kill an ox. We are feeling weak. We have had neither beans nor meat for a long time. At 3:30 we heard some shots in a north-northwestern direction, and we waited without dinner till seven o'clock for a man to bring us meat. Unfortunately he did not come, and we had to get along on coffee. I have a horror of rice and *farinha*. I am thinking of home every moment.

TAGANANÍ INDIANS

March 14. Today is Sunday. At these times I think of the Sundays I used to spend at home. I am oppressed with homesickness. The men have arrived with part of the ox, the rest having been left till the afternoon. At 10 o'clock I heard Indian shouts. At 10:30 the Indians arrived at our camp. They are Tagananís. They brought us presents of manioc, and I, in turn, gave them beef. After giving me certain information, they said they were going lower down to wait for us on the bank of the river; on passing I should shout, to be certain of them, the following: ''Taganano-cheriloculato-chiro.'' They gave me information about the affluents and their names. This river they call ''Caruiduiandé.''

I made today the survey of the river between Camp No. 6 and Camp No. 7. It rains constantly, and the weather is cloudy and damp. I was obliged to set up camp here, where we shall delay two, three, or four days. According to what the men tell me, the river is still blocked, though not so much.

THE BLOCKED RIVER

March 15. It is a month today since the Colonel made us his farewell visit, and—a great coincidence—the men found at nearly the same hour that he arrived in our camp, the message he had left on a pole at the foot bridge that the Cananîs use for crossing the river. The message reads:

''Ananáz, or Carumuriarú, River, 2-11-1915. A good trip to the undaunted explorers of the Ananáz, or Carumuriarú, River. P. S. A little lower down, Heron Creek comes in.''

I had expected to find this message on one of the poles of the foot bridge that the Indians use in crossing the river at the place of our camp, and I thought we had passed the Heron and Longuiaré Creeks already. Surely now we shall find them, and the river will offer better conditions for navigation. There is not a day or a night it does not rain. The sun is completely demoralized, for it comes out very little.

March 16. The horrid rain will not stop; day and night it rains. I made today the survey of the river between this camp and the next, Camp No. 8. Rarely does one see a high bank. The view gives one the impression of a great plain covered with water, having in the middle a strong current, varying from 5 to 25 meters in width. The woods are low, grown up with bushes like a swamp, with thickets of cane which appear to grow outward from the bank to close up the river. It is impossible to get by without first cleaning out the river.

In the elevated places the woods are clearer, and the trees are 20 to 25 meters high, and more. It is not only the thicket that blocks up the river, it is the fallen trees, felled by the action of time and by the stone or steel ax of the Indian. There are logs 80 centimeters thick, and the men have great difficulty in cutting them. They left today a log 40 centimeters below the surface of the water, which does not obstruct the passing of the boats. Tomorrow I move the camp. The water is lower, making necessary more work to cut out the logs. It is raining. The water is rising, and we cannot get along in this place. Indeed it is a constant struggle, and one which I have to keep up a long time in order to come out victor.

Colonel Rondon told me that in four or five days from the time I left Camp No. 1, I should be at the bridge of the Cananîs, where he left the message found by the men yesterday; but it has already been sixteen days. Today I made, with the help of the men, a raft of two boats to carry our supplies. From now on it will not be necessary, in moving the camp, to send the boats back on a second trip to bring the load that we have not been able to carry on the first trip.

March 17. Today, early, I moved to Camp No. 8 on the right bank of the landing at the bridge of the Cananîs, where Colonel Rondon left the message for us. Thank God, the raft came through safely. Contrary to my expectations, it did not bring everything, the beef having increased the load a great deal. This was due to the green poles used in building the raft. As soon as these dry, she will carry all the freight and five men.

More Indians

Today I received a visit from seven Indians. They brought me nothing and wanted some beef. One of them behaved badly and was defiant. I was stern with him, and they soon departed. I am eager to get away from this repulsive tribe.

March 18. The day passed without any change in the aspect of things.

March 19. I moved today to Camp No. 9. I was alarmed about the raft, which took in water twice. The river has improved a little, but has some dangerous turns. Two Indians, Maloquinindê and Taquintidê, spent the day with me, and the scoundrels did not make me any presents.

March 20. We are nearly at the end of the month, and I have done comparatively nothing. The narrow river does not allow you to make a kilometer a day of survey. As far as this place it has received only two large tributaries, which contribute much to its improvement over the section above. These tributaries are the Tiravé and the Heron. The Longuiaré, of which the Indians spoke, cannot be far away, as also the Marciano Avila, where the Tagananís live, who visited me at Camp No. 7. I am anxious to get down to hard work, in order to get home as soon as possible, for my homesickness is great.

March 21. I moved to Camp No. 10, 30 meters above water. I never saw such a plague of insects.

March 22. In order to do my map drafting, I was obliged to stay under the mosquito net, on account of the *piums*, *borrachudo* gnats, *carrapanás* (long-legged gnats), and a thousand varieties of bees. At 12 o'clock the canoe that was coming after the provisions went back because the Indians had blocked the river.

I went down to meet them and verify the fact. We heard whisperings, and I shouted ''Tagananís'' three times. Not until the fourth shout did they answer me, and, soon after, they gave me some manioc roots, and one of them helped me to cut the tree that lay across the river; I went on down to where the men were at work. There I found an Indian, who was talking in a friendly way with the men. On coming back I observed that the river was better. There were beautiful stretches and broader, but still it was blocked in many places by snags and trees that lay fallen across it. At 3 P. M. I arrived at camp and found a group of Indians from the village of Camanhã. They had brought me four baskets of manioc, but, as always, for exchange.

Improved Character of the Stream

March 23. Today I made the survey of the river. I began to work at 6:10 in the morning and finished at 1:40 in the afternoon, as far as the next camping place, Camp No. 11. The river is much broader in places, and there are many spots of solid ground. As the river gets broader the land seems to become better. The solid spots extend toward the center and are very high, from 10 to 30 meters.

March 24. I moved at 6:30 to Camp No. 11, on the right bank of the river. The land is high, sandy, and dry 80 meters from the bank of the river. I always pass critical moments in moving the camp, because there are stretches of the river where the boat runs against driftwood or against logs and is carried away by the current. At 6 P. M. the men came back from their work, and the master workman, Terto, informed me that the river was narrower and getting deep and full of bends. The spots of solid ground were more numerous and were covered with high forests without undergrowth, the trees being very branchy. The woods where we are encamped are higher and very different from those behind us, for there are many varieties of hard timber and many rubber trees. Our camp was placed just above an Indian road running along the bank of the river.

When shall I get to Manáos?

Longuiaré Creek

March 26. At 6 A. M. I began the work of survey and finished at 10:30. At midday we moved to Camp No. 12 on the right bank of the river. At last we have found the long-expected Longuiaré Creek. It only remains for us to find the Marciano Avila, and after this the river ought to be better. Here it is narrow and deep, 6 meters deep in places where it is very narrow. The spots of solid ground and the high forests continue to improve. There is neither game nor fish. At last I am enjoying health, but this terrible itch will not leave me.

March 27. This afternoon the men brought me good news. The Ananáz receives three tributaries on the right side, the second being eight meters broad, and is navigable for a good distance without interruption. I only pray God that we may be fortunate and make the trip as quickly as possible. These first days of the trip will give me some new experiences, but I shall soon become accustomed to it. Now indeed I am beginning a life of work. I have a great deal to do during the day surveying and at night drawing this awful daily map. Today is Saturday, and, as always on Saturdays and Sundays, I think a great deal about home. When shall I have the happiness to be at home? Maybe in June.

March 28. At 6:15 in the morning I moved to Camp No. 13. The river has really improved, but not as much as I expected. We made a record; for, at the same time we were moving and carrying everything with us, I made the survey of the river and broke the record of distance traveled, for this camping place is 6,700 meters below Camp No. 12.

Many Bends in the River

March 29. From the exploration that I made on land I learned that the rock wall that passes through our encampment extends a kilometer to the north, and from there another of different nature continues. This great wall varies from 5 to 8 meters in height, and above it extends open *campo*. This open land is from 26 to 30 meters above water level.

March 30. At 6:30 I went to survey as far as the Camp No. 14. The river has some stretches that are worse and very quick turns. I surveyed 3,881 meters, and it has more bends than the whole section between Camp No. 12 and Camp No. 13. On the right bank of the river is to be seen a beautiful natural meadow, the same that Laurindo saw from the top of a tree at Camp No. 13. It runs along the river but gets farther and farther away until it disappears from sight.

March 31. It is a month since I left the first camp. How slowly this month has passed, and how little work I have done! If I could have foreseen all this, I should not have allowed the men to live on *farinha* and rice at the beginning of an exploration in which we have gone only 30 kilometers out of 1,200. Let everything be, however, as God may wish it.

Illness Begins

April 1. We moved to Camp No. 15. The river has grown so much better that today we continued our voyage. Everything goes well, except that I am troubled with itching and with my stomach.

April 2. At 5:30 I moved the camp. At 5 o'clock I went into camp, having made 8,000 meters of survey. We found a beautiful meadow, and there the river is 22 meters wide. We thought the river would go on improving constantly, but, suddenly, it begins to broaden until it is 10 meters wide. In the afternoon it got broader but near our camp it is better.

April 6. I have been very ill; however, I have worked when I could.

April 8. Yesterday at 10 o'clock, on account of the state of my health, I was obliged to leave off surveying and go to bed. Only my state of health, which has changed a great deal in these last days, could oblige me to abandon a work which, with so much pleasure, I have begun and which I was carrying out with great satisfaction, in spite of the thousand reverses that have hindered me. I know that the responsibility of this work, in charge of which Colonel Rondon has placed me, is very great.

But what shall I do? Shall I sacrifice my life without results camping on one of the banks of this marshy river from which I have no resources and with no hope of improvement? Surely not. Weak with fever, with intestinal troubles, and with a stomach unable to hold any food, I can only submit to the kind of food I have at my disposal. This, my act, was absolutely not prompted by any impression I have of my health. It was not fear that moved me. I have become ill many times and, thank God, have never lost courage. I have always had the strength for my work.

Therefore, let my chief judge of my case after he hears it.

The life I have led these last days has been terrible. There was one day when we spent seven hours at night on a little knoll only two meters square, consisting of damp earth and situated in a mud hole surrounded by palms.

Food Difficulties

This was the best land we could find. The food for the men consists of *farinha* and rice, and mine is a cup of condensed milk. The river has nothing for us to eat. Fortunately this afternoon everything changed. The banks of the river ceased to be covered with water. The river is broader, and we succeeded in killing two *cojubins* for dinner. We found a field formerly cultivated by the Indians and, behind this, a large cultivated field of manioc still green; the field extends to the bank of the river and to an affluent six meters broad. These fields are usually on the left bank of the Ananáz and have been made with implements given the Indians by Colonel Rondon.

At about 10 o'clock we passed other formerly cultivated fields where there exist signs of the stone ax in some places both on the left and right bank of the river. I left a bench mark at the place where I finished the survey.

April 9. Today is my birthday. I imagine how much they are thinking about me at home. Oh that I were in the bosom of my family! Alone here, without a friend, without a person with whom to converse or exchange ideas! I am going down this river without knowing, with certainty, where I shall arrive. Here in this wilderness, where one does not see a living being, my mind, from early this morning, has been filled with thoughts of all those that are dear to me. When shall I be in Manáos?

We have not seen a single sign of an Indian during the whole day. We are probably, therefore, leaving behind us the Nhambiquaras, including the Tagananís, who told us that they would wait for me to give them my battle ax, my knife, etc. I pray God I may not meet another Indian and may not have to think of them. Only yesterday I was saying to myself in the hours of meditation: ''The best gift that God could give me on my birthday would be the confluence of this river with the Roosevelt.'' But I have not lost courage yet. I have great hope of reaching that river. If I succeed, I shall be able to give myself a treat. The width of the river here is from 28 to 30 meters.

Shoals, Rapids, and Falls

At 4 o'clock in the afternoon we passed the first shoals in the river. Since 12:30 we have been realizing that we are approaching falls because we have seen, almost at the surface of the water, enormous rocks. Fortunately we passed all the rapids in the river without incident. On account of fallen trees the water runs rather rapidly.

The noise made by the water running against the trees was much like the roar of falls. At 4:15 we heard a noise like the roar of a great cataract. At 6 o'clock the existence of the cataract a little below was confirmed. I gave it the name of ''The Ninth of April.'' The information given us by the Nhambiquaras was correct.

SOUTH AMERICAN ALLIANCES: SOME POLITICAL AND GEOGRAPHICAL CONSIDERATIONS

By OSGOOD HARDY

From the standpoint of international relations one of the most striking effects of the European War has been the ending of the Triple Alliance and the probable merging of the Triple Entente into the League of Nations or some organization akin to it. The decline in importance of these two great international *rapprochements* has been watched with interest throughout the civilized world—an interest so great that we have almost lost sight of the effect of the war on the most famous American *entente cordiale,* namely, the so-called A. B. C. Alliance of Argentina, Brazil, and Chile.

THE A. B. C. ALLIANCE

Before the war there was no small amount of discussion regarding its possibilities, and few writers on Latin American themes failed to give it considerable attention. During the war little was heard of it, and now that peace has come many are wondering if it will once more engross our attention. Thus far little has been heard of it although the newspapers of both Argentina and Brazil are advocating what is tantamount to an enlarged form of the A. B. C. Alliance which will include all the American republics; and they are declaring that a league of American nations should be formed before the South American republics enter the League of Nations as drawn up at Paris. It is to be expected that such discussions as these would take place; the only extraordinary feature is that in them there has been made no attempt to resurrect the A. B. C. Alliance. The questions therefore come to mind, "Is the A. B. C. a thing of the past, and, if so, why?"

In the opinion of the writer, the attempt to form an alliance of the A. B. C. Powers of South America is dead and will never be revived. In a few short years it has become as obsolete as that famous old alliance of more sacred name which called into being our national shibboleth, the Monroe Doctrine. Why it has become obsolete and why it will remain so, it is the purpose of this article to point out. The question will be discussed from both the political and the geographical standpoint.

ITS POLITICAL BASIS

The political basis of the A. B. C. Alliance was unquestionably the fear on the part of Argentina, Brazil, and Chile that when the United States backed up the Monroe Doctrine and professed that it stood ready to defend the postulate "America for the Americans" it was really keeping its tongue in its cheek and meaning all the time "America for the North Americans." They saw us drive Spain from the New World, keeping Porto Rico for ourselves and retaining a controlling interest in the affairs of Cuba. When later we "took Panama" (to quote the words of our greatest American), they were very much inclined to believe that the "Colossus of the North" was to be feared by all the republics in the Southern Hemisphere. Accordingly Argentina and Chile, luxuriating in a spirit of friendliness which sprang up after they had settled their boundary disputes and had beaten several of their cannon into the "Christ of the Andes," got together with Brazil and formed what they hoped would be a powerful offset to the dominating influence of the United States.

In spite of its frankly anti-United States *motif* this movement was welcomed by many in this country. They felt that, if we could unite with the leading powers of South America, much of the burden of enforcing the Monroe Doctrine then resting on the United States could be shifted to them. Accordingly, when we were attempting to settle our troubles with the late Mr. Huerta of Mexico, representatives from Argentina, Brazil, and Chile were called into conference, and it was felt that a decided step had been taken towards the bringing into actual being of the A. B. C. Alliance.

The Effect of the War

The European War, however, not only put a quietus on operations for the time being but would seem also so to have changed the relative positions of the three powers concerned as to render a resumption of operations impossible. By its active entrance into the war, Brazil acquired an international position which is recognized with envy by the other two powers. Brazil was a signer of the Treaty of Peace and is a charter member of the League of Nations. The result is that the largest country in South America, because of its clean-cut stand against the Teutonic Powers, has received such recognition from the Allied Nations as gives it predominance in international affairs over both Argentina and Chile. At the same time a kindred desire on the part of both the United States and Brazil to continue the relationships engendered in fighting for a common cause has brought these two countries even more closely together today than in the times of the Emperor Dom Pedro, when our respect for the rising young nation to the south of us was signalized by the raising of the rank of our representative at Rio de Janeiro from minister to ambassador. No foreign statesman who has visited us in recent years has been received with greater acclaim and demonstrations of friendliness than was President Pessoa, and we believe it can be safely predicted that in the future Brazil will enter no alliance whose main *raison d'être* is hostility towards and fear of the United States.

Relations of Brazil and Chile

With the removal, as far as Brazil is concerned, of the foundation stone of the structure, the A. B. C. Alliance must fall. Only fear of an outside power ever brought Brazil into close relations with Argentina, for that country has long been Brazil's greatest rival, politically as well as economically. Although the two countries did combine successfully at one time for the purpose of overthrowing the tyrant López of Paraguay, their interests have been for the most part divergent rather than convergent. As for a friendship between Brazil and Chile, its only basis was a negative one. Not being contiguous they never had any boundary disputes; and, as both countries had extensive frontier litigations with Argentina, it was natural that their common hostility towards Argentina should bring them together. But later, when Argentina and Chile settled their troubles, this contributing cause was removed, and as Argentina and Chile became closer friends Brazil and Chile drifted apart. In fact, after the first Pan-American Scientific Congress, held at Santiago de Chile in 1908, Brazil's amity for Chile was somewhat cooled.

It is worth noting the occasion for this coolness, as it shows how really unimportant incidents may become factors in developing international ill feeling. At one of the most important sessions of the above-mentioned congress a leading Brazilian delegate gave a long and scholarly discourse. Unfortunately it was in Portuguese and consequently was understood by very few of the delegates. By reason of this and its lengthiness—for even Latin American politeness weakened under the strain of attempting to give careful attention to a long address which could not be understood—little attention was paid to it. Furthermore, the reporters did not give it much space in the papers of the following day. The result was that the Brazilian delegation was with difficulty prevented from withdrawing then and there.

Possibility of an Anti-United States Alliance

Chile, in consequence of several incidents in which our representatives preferred high-handed Yankee directness to diplomatic *savoir faire,* has been for the past generation the most anti-American of all the South American republics. If she, then, is to bring about the formation of an alliance for the purpose of combating the influence of the United States in Latin America it is certain she must look elsewhere than to Brazil for support. Furthermore, it is doubtful if Argentina would welcome any such advances. She realized that in supporting Germany she had placed her money on the wrong horse, and the frantic haste with which her Government accepted the invitation to become a member of the League of Nations and thereby swallowed whole the article which supposedly gives the support of the League to the Monroe Doctrine, would seem to indicate that Argentina, like Brazil, has outgrown her childish fear of us.

The only possibility of an anti-American alliance would seem to be, therefore, an alliance of Chile, Colombia, and Ecuador, and possibly Venezuela. As to the situation in Venezuela we know little, for President Gomez is exercising such a tight censorship that, politically speaking, our knowledge of darkest Africa before the explorations of Livingstone was encyclopedic compared with what we now know of the Venezuelan attitude towards international affairs. The traditional attitude of that country is of course anti-United States, although it is to be hoped that our enlarged commercial relations with her during the last five years may have dispelled a considerable amount of that hostility.

In regard to both Colombia and Ecuador it is also to be expected that the future will bring about a more friendly attitude towards the United States. Since the acquisition of independence by Panama the former country has naturally felt somewhat aggrieved. This feeling, however, has lessened in recent years; and, if the treaty which proposes to give her a $25,000,000 balm for her injuries is passed by the Senate, her wounds will undoubtedly be healed, especially as she is desirous of securing capital from the United States for the construction and extension of several essential railroads. Ecuador's hostility towards the United States is a relic of the days when Archer Harman's Guayaquil and Quito Railway Company refused to arrange its train schedules to meet the whims of Quito politicians, and it was not in any degree lessened during the period of canal construction when ships from Guayaquil to Panama were quarantined on account of the execrable sanitary conditions of the former port. In the last two years, however, the Ecuadorians have seen the light. General Gorgas was invited to clean up the "pest hole of the Pacific," and he did such an excellent piece of work that not only do ships now dare to stop at Guayaquil on their way northward, but the respect and thanks of the Ecuadorians themselves were accorded him.

Suggested Alliance of Colombia, Ecuador, Chile

At the same time it must be noted that the Ecuadorian press is seriously discussing the question of an alliance of Colombia, Ecuador, and Chile. One distinguished writer and diplomat has come out in the columns of *El Tiempo* of Quito with the plain statement that a union of these three South American republics is absolutely necessary. The reasons for this alliance the author of the article does not delineate clearly. They are, however, not difficult to supply. Both Brazil and Peru have claimed large parts of the Ecuadorian *montaña,* and the moral and material support of Chile would be of great aid to Ecuador in preventing the dismemberment of her trans-Andean hinterland. But it is of little importance what may be the reasons underlying this discussion; the fact remains that it is a straw which shows that the wind is blowing directly away from the A. B. C. Alliance.

Geographical Reasons Against a Revival of the A. B. C. Alliance

We believe, therefore, that we are safe in saying that there is no longer any diplomatic basis for an alliance of the A. B. C. Powers. With the disappearance of its diplomatic *raison d'être* that alliance cannot be resurrected, for it never had any geographical reason for existence. Chile is pre-eminently a mining country, and the purchasers of its raw materials are to be found entirely outside of South America. The temperate regions in south-central Chile, with proper development, can provide her with all the cereal and meat products she needs for her own consumption and thus make her independent of Peru and Argentina; while Colombia and Ecuador, if the efforts now being made by Chile to increase commercial relations with those countries prove successful, will provide her with all the tropical foodstuffs she requires. Isolated from the rest of South America by the gigantic barrier of the Andes, Chile is by natural conditions constrained to go her way alone. Blest with an invigorating climate, which has enabled the mixture of European immigrants with the strong Araucanian native stock to retain all its inherent virility, she has developed her army and navy to such a point that she little needs the aid of any other South American country.

Geographically Argentina has more in common with Paraguay and Uruguay than with any other parts of South America, and it would seem as if their common economic interests would draw these countries together. Such a union would certainly be advantageous to Paraguay, for her only navigable outlet to the Atlantic is the Paraná River, both banks of which in its lower course are in Argentina. Uruguay in its early history acted as a sort of buffer state between Argentina and Brazil, and attempts have been made by both these countries to include it within their boundaries. Its independence is now unquestioned; but the influence of a common language and common traditions and culture will naturally cause it to be more closely united with Argentina than with Brazil.

The Strength of Brazil

Brazil, on the other hand, in addition to being the political rival of Argentina, will in the future be its greatest economic competitor. Brazil has come to realize that the policy of carrying all its eggs in one basket, or at most in two, is dangerous in the extreme. Rubber and coffee have been, in the past, its two chief products. The rise of the East Indian cultivated rubber industry has shown that the days of Brazil's caoutchouc wealth are numbered; while increased sales of coffee by the Caribbean countries to the United States, long Brazil's chief customer, have convinced many Brazilian economists that the future wealth of their country depends on the development of the cereal and live stock regions in the southern states of Rio Grande do Sul, Santa Catharina, and Paraná. One very important effect of the European War was the great impetus it gave to the diversification of Brazilian industries. The development of that part of Brazil which most closely resembles Argentina and Uruguay has made and excellent start. As these states become important Brazil will more and more become a competitor of the River Plate countries. This competition, added to the political rivalry between the two countries, both of which aspire to be the leading nation of the Southern Hemisphere—a rivalry accentuated by the absolutely divergent attitudes towards the European War—will cause Brazil to turn to some other country rather than to Argentina if she desires to form alliances in South America.

Possible Alliance of Peru with Brazil

As to which country she would join, only a conjecture can be made, but it seems logical to think that it would be Peru. An alliance with Brazil would in all probability be welcomed with open arms by Peru, for the two countries have much in common. Both have at all times been on very friendly terms with the United States. From the beginning of the European War Peru was also strongly pro-Ally and, although she never actually entered the war, broke off diplomatic relations with Germany and was far from feeling the benevolent neutrality towards the Teutonic Powers maintained by Chile and Argentina. The boundary troubles between Brazil and Peru have been equitably settled, and the common interests between the *montaña* of Peru and its natural outlet, the Amazon Basin of Brazil, will naturally be a factor in bringing about a closer relationship. Finally, Peru is naturally possessed of an undying hatred for Chile, and she needs the moral and material support of her strong neighbor if she is ever to secure the return of her "Alsace-Lorraine."

Participation of Bolivia

In any such *entente cordiale* between Peru and Brazil, Bolivia would in all probability be a participant also. Before the war it seemed as if she had resigned herself to the inevitable and, with the completion of the Arica Railroad by Chile, had settled down to a policy of receiving with thanks any favors which Chile, her conqueror in the War of the Pacific, might see fit to dispense. Today all is changed. The statements of Mr. Wilson regarding the rights of small nations and his friendly attitude towards the agitation of the Czecho-Slovaks regarding an ocean outlet revived the long dormant hopes of the Bolivians for a port on the Pacific. Their demand, when placed before the Peace Conference, received no attention; but, in spite of this damper, a heated political controversy is now in progress, one party to which, under the leadership of ex-President Montes, is urging that the Government seek the immediate concession of a seaport. As Peru is attempting to secure the taking (under conditions that would assure her the victory) of the long overdue plebiscite to determine the ownership of Tacna and Arica, she would welcome Bolivia's presence in any alliance with Brazil.

CONCLUSION

In the opinion of the writer, therefore, it seems improbable that the defunct alliance of the A. B. C. Powers of South America will be resurrected. There is neither diplomatic nor geographical reason for its revival. On the contrary, it is predicted that the future will see three diplomatic understandings, if not alliances, in the Southern Hemisphere. In the center of the continent, and predominant, will be a union of interests between Brazil, Peru, and Bolivia. South of that Argentina, Uruguay, and Paraguay will tend to merge their interests. The third group will be made up of Chile, Colombia, and Ecuador.

From the standpoint of our interests in South America such a grouping would be decidedly advantageous. The central trio is already friendly towards us. The River Plate countries are finding the United States an increasingly profitable market with which to trade, and it should be an easy matter for us to win their friendship. The third group of republics is frankly suspicious of us; but Colombia and Ecuador are becoming less so, and, if we can refrain from mixing in the Tacna-Arica question, there is little doubt that time will dissipate the unpleasant memories of the *Itata, Baltimore,* and Alsop incidents and make it possible for us to secure the regard of the one country whose people, in our attempts to flatter, we have often called "the Yankees of South America."

PASSARGE'S PRINCIPLES OF LANDSCAPE DESCRIPTION

By W. M. DAVIS

Dr. Siegfried Passarge, known fifteen years ago for his explorations in South Africa, where he came upon the important idea of "leveling without base-leveling," and subsequently professor of geography at the University of Hamburg, has frequently urged the importance of carefully studying the facts of the visible landscape before attempting to explain them. He now makes practical application of this manifest principle in a textbook, "Beschreibende Landschaftskunde," the first part of a contemplated four-volume work, "Die Grundlagen der Landschaftskunde," which is as a whole intended to serve as a guide to the investigation and description of the visible features of geographical areas in their natural combinations. It is well said in the introduction to the first volume, now issued,[1] that the study of the visible landscape is a branch of geography which has at last secured the place it should have long since occupied; for a knowledge of geographical spaces and their contents is the indispensable foundation on which all geographical descriptions and generalizations must be built; and it is furthermore held to be a scientific necessity that the study of landscapes, including their land forms, atmospheric effects, plants, animals, and human inhabitants, as they are actually seen to occur together, should begin with an empirical description of facts of observation, uninfluenced by theoretical or explanatory preconceptions. The volume before us aims to assure the accomplishment of this empirical task.

SYSTEMATIC ANALYSIS OF LANDSCAPES

The first 15 pages present a systematic analysis of landscapes (*planvolle Landschaftszergliederung*), which is intended to aid the observer towards thorough work by compactly listing the many kinds of features of which landscapes may be composed. Thus atmospheric effects are allowed 76 headings; land forms, together with streams, lakes, and shore lines, several hundred; plants, animals, and man are treated with similar liberality. As examples, under the relation of lakes to rivers, we find *Blindseen, Quellseen, Endseen, Durchgangsseen, Hochflutseen, Haffe, Limane, Deltaseen;* under cliff coasts, *Hohlkehle, Grotten, Höhlen, Tore, Kliffkanäle, Kliffdolinen, Kliffnischen, Strandstufen, hängende Täler, Felsenstrand, Felsenwatt;* under plan of settlements, *Einzelhöfe, Einzelgehöftdörfer, Haufendörfer, Runddörfer, Strassendörfer, Kettendörfer,*

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[1] Siegfried Passarge: Die Grundlagen der Landschaftskunde: Ein Lehrbuch und eine Anleitung zu landschaftskundlicher Forschung und Darstellung, Band I, Beschreibende Landschaftskunde. 210 pp.; diagrs., ills. L. Friederichsen & Co., Hamburg, 1919.

Festungsdörfer, Waldinseldörfer, Festungen, Burgen, befestigte Gemarkungen. It is not to be doubted that these lists will aid the otherwise untrained traveler in making thorough notes, for few travelers possess either a good enough power of observation to recognize or a sufficiently extended vocabulary to name the manifold features that they encounter.

Description of Visible Landscape Features: Land Forms

The meaning of the terms listed in Part I is explained in Part II, "Beschreibende Landschaftskunde," which occupies three-quarters of the book. The method here adopted may be illustrated by the treatment of land forms. These fundamental features are first classed as individual and as composite forms (*Grundformen und Gruppenformen*). The individual forms are mountains, valleys, plains, etc., each of which is composed of certain elements that cannot exist alone; thus a mountain has a summit, slopes, and base; a valley has sides, floor, and river channel. Composite forms, such as mountain ranges, are made up of many individual peaks, domes, and ridges; and composite forms are associated in larger regions and zones. The classification is thorough, sometimes to the point of being labored, as is indicated by the three lists of terms given above. The variety of forms treated is great, and a knowledge of them is profitable; but, as might be expected in any such text, certain items of equal rank with those included are not mentioned. Among omitted items are: the varied forms of spurs in incised meandering valleys, the frequently occurring "underfit" relation of stream curves to incised-valley curves, the cusps and concaves of terrace fronts, the upstream breaking of standing waves in rushing torrents, the prevalently discordant junction of small and large stream beds, the daily length-variations of mountain-ravine streams in arid regions, the reflection of waves from partly submerged cliff faces, the refraction of surf so that it arrives on beaches nearly coincident with their curves, the relation of beach detritus to the rock floor on which it usually lies, the peculiar behavior of 'long-shore tidal currents with relation to high and low water, the color of sea water on coral-reef flats. It is not so much the number as the significance of these omitted items that is striking.

Avoidance of Explanatory Terms

The effort to avoid explanatory terms and to limit the definitions and descriptions of individual forms to empirical statements is remarkably successful, although it evidently involves the suppression of elementary explanations that are perfectly familiar to the author, for they are well established and universally accepted. The names given to individual and composite forms are also in nearly every case free from explanatory implication, although this cannot be said of *Durchbruchstal* and *Vulkan*. Many names, like *Ringwallwasserscheide, Zwischengebirgstäler,* and *Fluss-*

mündungsküste, are compounded in a manner to which the German language lends itself with exceptional facility. Yet, in spite of the intention to give purely empirical definitions, explanatory inferences creep in here and there and clearly carry the brief descriptions beyond the narrow limits of direct observation. For example, *zerplatzte Felsblöcke* is the phrase applied to the severed parts of a weathered boulder, although its splitting is inferred and not seen. Mountain torrents are said to lay down their detritus in fans where they enter a main valley, although even if an observer happens actually to see a small volume of detritus thus deposited, it is only by inference that he knows the entire fan to be of similar origin. Flood plains are said to show various signs of past and hence inferred flood action, such as deposits of sand and gravel, or old and fresh stream channels. The diagram of a longitudinal valley-terrace includes a foreground section in block-diagram style, in which valley-floor alluvium is drawn as lying upon an inferred underground extension of the valley sides. Likewise, the block diagrams of certain concentrically grouped ridges of oval ground plan, to which the names of *Kragenberg* and *Kragenwallberg* are given, show in their frontal sections that the ridges are the surface expression of inferred but invisible underground structures of anticlinal and synclinal arrangement. The distributaries of a river on a delta are said to flow between self-made levees. Marshy coasts are said to be formed where rivers deposit their sediments, although deltas are not similarly explained. Cliff-foot caves are said to be excavated by the surf, although gorges are not ascribed to stream erosion. A gravel-covered bench in a sea-facing cliff is named *gehobene Strandstufe,* yet embayed coasts are not explained by the submergence of valleys. ''Islands become land-tied, bays are filled up.'' As to coral reefs, ''one gains the impression that a high island sinks and its fringing reef survives as a smaller atoll, or its barrier reef as a larger one;'' and the sections by which fringing and barrier reefs are illustrated show the extension of an inferred foundation slope from the island beneath the reef.

In the chapter on man, inferences as to the reasons by which the location of villages has been determined are frequently suggested; indeed, although the treatment professes to be purely descriptive, human settlements are explicitly said to be usually determined by such factors as soil, water, or plant growth, thus indicating the recognition of a highly reasonable explanatory preconception as to cause-and-effect relations; yet such causal relations clearly lie beyond the reach of direct observation, in so far as they concern the reason for the location of a village. Furthermore, certain villages in peculiar situations, difficult of access, are called refuge villages; towns on the higher bank of a stream were placed there to avoid overflow during floods; river fords and bridgeable narrows are treated as frequent causes of village or city location; a special explanation is given for the peculiar location of some small settlements away from the springs of an arid region (p. 148); and a socialistic extension of observation into prediction is found in the statement: "Factories are like bombs with time fuses. . . . When industrialism prevails, it sooner or later leads irremediably to disaster."

These failures to present purely empirical definitions and descriptions illustrate the natural and constantly increasing habit of treating geographical matters rationally in these modern days of evolutionary philosophy; but they form so small a part of the text that they do not seriously lessen the value of Passarge's book as an empirical "Beschreibende Landschaftskunde." As has been said, a knowledge of all the features here described would be of great value to every geographer, and especially to the traveler who, untrained in geography, nevertheless wishes to make some record of his geographical observations.

THE OUTLINE ILLUSTRATIONS

The meaning of a good number of the terms is made clearer by small figures in the text, among which those illustrating different kinds of human settlements are to be particularly commended, as most of them seem to be copied from authentic pictures of actual examples. Unfortunately the same cannot be said of the small figures of land forms, reproduced from drawings by Passarge's laboratory assistant; many of them are seriously inadequate, in that they are not accurate representations of actual *Grundformen* taken from existing landscapes but are roughly drawn ideal figures, many of their lines being inexpressive to the point of inaccuracy. Some of the illustrations are mere profiles which, as in certain instances already noted, not only depart from the plan of the book by showing inferences concerning invisible underground structures but also fail fully to realize the object of the book by not giving its readers good presentations of surface facts. Such bare profiles may serve to summarize the impressions of an observer who has seen the facts out of doors, but they do not suffice as indoor reproductions for students who have not seen the facts. Other illustrations are schematic diagrams, which appear to have been designed by an artist inexperienced in sketching the original objects rather than to have been drawn from nature by a skillful and critical observer. The volume of a river in a narrow and steep-sided mountain valley is enormously exaggerated; flood-plain scrolls, inappropriately named *Halbmonde*, are not shown in their characteristic pattern; the scrappy little marks intended to represent a talus-covered slope beneath a rocky knob are most inexpressive; two elongated table mountains are shown with flat tops and sharply defined rims, but they have no well-developed cliffs, by the upper edge of which alone their rims can be sharply defined; a cliff-rimmed mesa, or *Kranzberg*, has a thin cliff-making stratum at mid-height, correctly drawn on its left profile but incorrectly drawn on its right profile. Empirical descriptions may, of course, be based on these inadequate drawings if desired, but in a book that professes to hold closely to facts and that excludes all explanatory terms and rational descriptions, drawings so rough, not to say misleading, as some of these are seem out of place.

Descriptions of Actual Land Areas

The last 35 pages of the book are occupied by a supplement, containing nearly eighty empirical descriptions of actual land areas, intended to serve as examples for imitation. Over fifty of these descriptions are based on Baedeker maps; about twenty more are prepared from pictures, some of which are cited in certain books of travel, while others are here given in plates at the end of the text. One of these views, a drawing from a model of the Mont Blanc group, is seriously wrong in failing to show the strong discordance of levels between the hanging side trough of the Mer de Glace and the overdeepened main trough of Chamonix. It is interesting to note that in a number of these empirical descriptions, Passarge guards some of his statements of fact by qualifying them with *"anscheinend"* or *"augenscheinlich,"* just as geographers who prefer explanatory descriptions use similar words to indicate doubt as to the explanations they propose. Some of the descriptions extend, apparently by inference, beyond the facts shown in the pictures; as in making mention of *Sand* on an arid plain, and of *Schutt* on a distant mountain slope. Preconceptions are occasionally implied, as in the use of *zerschnitten* in describing mountain slopes, of *gerundet* instead of *rund* in describing a certain ridge crest, and of *einschneidend* in describing a certain valley. In general, however, the descriptions hold closely to the facts. One of the best examples (p. 170) is only 16 lines in length.

> Über einer mässig steilen, zerschluchteten Buschwaldböschung erhebt sich eine schroffe, kahle, zerklüftete Felsenmauer als Gipfel des wohl +1000 *m* hohen Tafelberges, dessen Oberfläche eine von waldigen Randschluchten zerschnittene, wellige Grasflur bildet. Aus den Gehängeschluchten heraus entwickeln sich in der Ebene gewundene, steil eingeschnittene Galeriewaldflüsse, die von trockenen, grasigen Überschwemmungsflächen mit zerstreuten Palmen eingefasst werden. Zwischen den Flüssen erheben sich niedrige, gelblich-bräunliche Baumsavannen-Platten, die mit steilem Rand zu der grünen Überschwemmungssohle abfallen. Aus den einförmigen Flächen der Steppenplatten ragen die kahlen Rotlehmkegel der Termiten auf. Rundliche Buschwaldinseln erfüllen den Boden von flachen Sandpfannen, die hier und da eingesenkt sind. In der Überschwemmungs-Grasflur weiden Herden von Antilopen, deren Wechsel als schmale rote Linien die Savannenplatten durchziehen. Aus einer Schlucht des Berges aufsteigender Rauch verrät die Schlupfwinkel eines Stammes, der sich in die unzugängliche Fels- und Buschwildnis des Berges zuruckgezogen hat.

This may well serve as a model, so vividly does it present a picture of the landscape it describes; and yet even this model contains light touches of explanation, for it suggests the inferred action of an inorganic process in using *"eingeschnitten"* to describe certain streams, and an inferred human motive in using *"zurückgezogen"* in telling of the nearly inaccessible refuge of a savage tribe. Without doubt the study of a moderate number of such descriptions and the preparation of several more would be beneficial to all earnest students of geography; but it is hard to believe that the lesson to be thus learned is so difficult that the many sample descriptions here given are necessary.

THE VOLUME AS A UNIVERSITY TEXTBOOK

The logic of Passarge's method is beyond dispute, and, as has already been pointed out, his present book must prove highly serviceable to travelers who do not profess to be geographers but wish to give some account of their travels. Such observers would be greatly aided by the introductory suggestions in the "Planvolle Landschaftszergliederung" and by the descriptive definitions in the body of the book. But that a book of this nature should be regarded as an essential foundation for university instruction in geography, especially for beginners, is quite another matter. The propriety of giving so much space to the empirical first step of university instruction in geography is pedagogically very questionable. No one disputes the necessity for abundant observational study of geographical facts. No one proposes to describe landscapes by substituting theoretical explanations for direct observation. Even those geographers who wish to replace empirical description by explanatory description as far as it is reasonably possible to do so, fully agree that, when an actual landscape is to be described, the observation of its features must come first and their description, of whatever kind, second. This is logically inevitable; but it by no means follows that the preparatory indoor study, which is for the most part non-observational, must be even in its introductory stage limited to empirical definitions and descriptions, from which all rational, explanatory treatment is excluded. It would be a most melancholy error if all inquiry as to cause should be repressed while a book of 210 pages is studied through. To what extent and by what method Passarge proposes eventually to use explanatory terms and descriptions will appear in the later parts of his four-volume work. In the meantime the first step of his procedure, as now presented, may be evaluated.

A high value unquestionably attaches to a knowledge of a large variety of empirically defined types and to the preparation of empirical records of directly observed facts; but in teaching university students it is by no means necessary to continue such exercises so far as Passarge's book demands before any explanatory description is permitted. Indeed, it may be well urged that, while a certain amount of indoor practice in empirical description from maps and pictures is useful, the best occasion for practice in the empirical description of observed facts is found during outdoor excursions, which should therefore be conducted slowly enough to allow time for deliberate sketching and description while the objects to be described are in sight. In contrast with these observational outdoor exercises, the greater share of indoor study may well be given to theoretical explanations, the consideration of which should not be long delayed. Indeed, the postponement of explanation for so long a time as the use of Passarge's book would demand has no parallel in the teaching of other sciences. In geometry the many facts concerning points, lines, distances, surfaces, angles, areas, solids, and volumes are not all first defined empirically and afterwards reviewed with demonstrative explanations; rational treatment is from the beginning closely associated with definition. Any other procedure would be fatiguing and discouraging. Students of physics are not required to observe and describe a large variety of phenomena before any account of invisible theoretical matters is introduced. Observation, description, and explanation are closely associated in laboratory work, textbook study, and lectures, as the successive subdivisions of physics are learned.

Similarly a close association of rational explanation with observation and description is desirable in geography. Inquiries as to meaning and cause must inevitably arise during the presentation of a series of geographical facts to a class of right-minded, bright-minded young students; and it would be most unfortunate if the teacher should attempt to suppress such inquiry by announcing that all explanations must be postponed until the next semester. Inquiry as well as observation should be encouraged and utilized; for at the moment of inquiry the student mind is as ready for the reception of an explanation as a chemical element in the nascent state is ready to enter into a new combination. Reasonable care should of course be used as to the confidence with which the explanatory treatment of different landscape factors is introduced; but, as far as land forms are concerned, it would surely be unreasonably skeptical today to exclude mention of the work of weather and streams in the description of mountains and valleys, of submergence in the study of embayed coasts, of glacial erosion in telling about cirques and hanging valleys, of glacial deposition in telling about drumlins and till plains, and of various other explanatory processes in giving accounts of many well-understood landscape features. It is probable that zoögeographers and anthropogeographers would hold similar opinions as to the treatment of many problems concerning the well-understood organic elements of landscapes.

If a teacher, in attempting to carry out a dry logical plan, excludes all explanatory treatment for several months from so rationally treatable a subject as the geographical landscape, his students will outdistance him, especially if they have already had an introduction to rational geography before entering upon their university studies; for unless they are an exceptionally dull lot, their inquiring minds will spontaneously refuse to be stifled: if their teacher will not discuss explanations with them, they will discuss explanations with one another.

A textbook that imposes upon those who use it a prolonged empirical treatment, from which all the refreshing juice of explanation has been squeezed out, has a savor of heavy laboriousness. Such a book, unless in the hands of an experienced explorer who could not refrain from now and then adding an invigorating flavor of explanation, would make dull grinds out of its students and exacting Gradgrinds out of its teachers. It is difficult to understand how its arid method can be advocated by a man so experienced in exploration and so expert in explanation as Passarge.

How different were the educational principles of Gilbert, our American master of geomorphology! He thought that the important thing in education is to train scientists rather than to teach science and that "the practical questions for the teacher are whether it is possible by training to improve the guessing faculty and, if so, how is it to be done:" he furthermore believed that the content of a science is often presented so abundantly as to obstruct the communication of its essence and that the teacher "will do better to contract the phenomenal and to enlarge the logical side of his subject, so as to dwell on the philosophy of the science rather than on its material."

It would be imprudent to predict how far German professors and German students of geography will be content to accept so tediously prolonged an empirical introduction to their science as the "Beschreibende Landschaftskunde" imposes; but, except that it may have a certain value as a work of reference in association with texts of an explanatory nature, a book of this kind is not likely to be used in the United States.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Roosevelt Geographical Exhibit. From October 18 to October 26 the American Geographical Society, in co-operation with the Roosevelt Memorial Association, held an exhibit dealing with Colonel Roosevelt's geographical activities. There were shown the official map of the "River of Doubt," autograph unpublished letters of Colonel Roosevelt and Colonel Rondon, his Brazilian associate, throwing light on his exploration of the river, and other material relating to his South American and African expeditions. Replicas of the gold medals awarded to Colonel Roosevelt and Colonel Rondon by the American Geographical Society were also on view, as well as the autograph copy of Colonel Roosevelt's address to the Society (see the *Review* for April, 1917) at the time of the award—just before the entry of the United States into the war—which ends with the passage: "We must put service first—not safety first; and we must act with that lofty and noble idealism which expends itself, not in empty words, but in action which recognizes the elemental fact that those men only are fit to live who are not afraid to die."

NORTH AMERICA

The Culture of the Southern States. Some of the recent writings of Dr. Roland M. Harper may serve as an antidote to the self-satisfaction which the Northern States are apt to feel because of their obvious achievements in certain lines of material effort. Whether they agree with him or not, geographers ought at least to think the matter over when he presents statistics which seem to him, for example, to show that illiteracy "is not such a menace as some persons seem to think. . . . Perhaps the ideal state of civilization would be to have about 6 per cent of the adult population illiterate and about the same number college graduates, and the rest distributed uniformly through the intermediate grades" (Illiteracy in Alabama: Where and Why, *Montgomery (Ala.) Advertiser*, June 1, 1919). Again: "Some Northern writers who know so little about the South that they are prejudiced against it claim that the presence of an inferior race in large numbers is bound to lower the standards of the dominant race; but I have recently worked out some statistics that show exactly the opposite tendency. . . . Where negroes are most numerous the whites are most prosperous and cultured" (High Living Standards in "Black" Counties in the Southeastern United States, *Montgomery Advertiser*, March 28, 1919). In still another paper (The Distribution of Illiteracy in Georgia and Its Significance, *High School Quarterly*, Athens, Ga., Vol. 7, 1919, pp. 254-262) Harper advances the idea that compulsory education is the cause of the undeniably great amount of illiteracy in some of the manufacturing cities of the North. "Compulsory education . . . . tends to create a vacuum at the bottom of the industrial scale, which can be filled in part by using child labor, or better by importing immigrants old enough to be exempt from the education laws, from states or countries that have no such laws."

It would be easy to criticize these statements, but there is no denying the value and interest of certain facts which lie back of them. For example, in Alabama, Mississippi, and Louisiana the nine counties—or parishes as they are called in Louisiana—which have the greatest percentage of negroes rank at the very top in the value of the farm buildings of the few whites, while the number of white children who go to college is also above the general average. This illustrates a general and striking fact, which Harper brings out clearly: "Not only in Georgia, but also in other Southeastern States, where negroes are most numerous the contrast between the two races in education is greatest." This does not mean merely that the negroes in such isolated regions are ignorant because of their isolation from the white man but that the few whites are above the average for that part of the country in education and wealth. It means also, although Harper does not say it, that in such regions the social demarcation between white and colored, and also the contrast in the amount of land per individual, are at a maximum. There more than elsewhere the whites still own and control the land and presumably are above the average in inherited ability. Other whites of lower grade do not come because there is little land for sale and because they do not care to compete with the negroes. Equally interesting are Harper's figures as to the well-known but not well-appreciated fact that where colored people are in the minority they tend to congregate in the towns and cities, while when whites are in a minority they, too, do likewise.

Much of Dr. Harper's effort is directed toward an attempt to prove that the climate of the South has nothing to do with illiteracy. To this end he gives figures for the different natural regions which he has worked out in Alabama and Georgia. Thereby he proves that the local distribution of illiteracy depends upon the relative isolation of large parts of the Southern States, the comparative sparsity of population, the small proportion of urban inhabitants, the comparative lack of wealth, and the slight amount of travel except in Florida, which is more literate than its neighbors. All this is excellent, but it proves nothing about climate, for nothing is said as to the possible relation between these other factors and the climatic factor. What it does prove is the extreme diversity of the various geographic controls which determine the degree of illiteracy. It also throws a valuable light on the geography of the Southeastern States, and it is to be hoped that Dr. Harper will continue to act as their geographic champion and gather his scattered observations into a single publication.

Ellsworth Huntington

AFRICA

Commercial Possibilities in the Salvage Islands. The Salvage Islands claim their share of wartime romance. A group of rocky islets lying midway between Madeira and the Canaries, they have heretofore been of little interest. No permanent habitation has been made on them because of the lack of a permanent water supply. Myriads of sea birds breed there, and the surrounding waters are excellent fishing grounds. Temporary occupation has been effected by a birding and fishing company. The company sustained losses during the war through the submarine campaign that preyed so effectively on Canary Islands shipping. It was suspected, though not proved, that the submarines had a base in one of the islets. Compensation, however, came when the company ''literally struck oil in the shape of the puffins.'' From the sale of oil and feathers collected in a few weeks the sum of $20,000 was realized (*The African World*, London, July 26, 1919, p. 480). This is said to be the beginning of more extensive operations, and it is also suggested that the islets may yield guano deposits of commercial value.

AUSTRALASIA AND OCEANIA

Hawaiian Mean Annual Rainfall a New World Record. In connection with high-level hydrometric work in the Hawaiian Islands, engineers of the U. S. Geological Survey have found it necessary to measure the rainfall at several places at elevations up to over 5,000 feet above sea level. The records so far obtained show that Cherrapunji, the famous station in the Khasi Hills of India, whose mean annual rainfall is given as 426 inches, has a rival in Mt. Waialeale, altitude 5,080 feet, on the island of Kauai, as reported by G. K. Larrison of the U. S. Geological Survey in the *Monthly Weather Review* (Vol. 47, 1919, pp. 303-305). During a recent period with a somewhat broken record covering nearly five years between 1911 and 1917, Mt. Waialeale averaged 476 inches of rainfall annually. In this period the total precipitation on 1,782 consecutive days was 2,325 inches, or a daily average of 1.30 inches. On account of the difficulty of access the station has unfortunately been discontinued. Other stations in the islands have also given remarkable heavy rainfalls, amounting, in single years, to 562 inches in one case and 504 inches in another. The maximum daily rainfall thus far recorded was 31.95 inches at Honomu, Hawaii, elevation 1,200 feet (February 20, 1918).

The Hawaiian Islands have long furnished ''stock'' examples of great contrasts in rainfall amounts at stations separated by but a few miles of distance but differing considerably in altitude and in exposure. Starting with Mt. Waialeale, with a mean annual precipitation of 476 inches, the following records, covering practically the same period, are now available.

	Elevation in Feet	Relative Position in Miles	Annual Rainfall in Inches
Mt. Waialeale	5,080	....	476
Olokele	2,100	2.0 S W.	149
Kokee	3,550	10.5 N.W.	56
Pali Trail	850	11.0 S.W.	16
North Wailua	650	4.0 E.	126

On the island of Maui the variations are still more remarkable. Stations near Puu Kukui, elevation 5,000 feet, with a mean of 369 inches (562 inches for 1918), give the following records:

	Elevation in Feet	Relative Position in Miles	Annual Rainfall in Inches
Puu Kuki	5,000	....	369
Kahoma Reservoir	2,000	4.0 W.	55
Kaanapali	12	7 5 N.W.	18
Wailuku village	390	5.5 S.E.	30

November, December, March, and April are usually the wettest months. The precipitation is ''showery,'' heavy rains rarely lasting more than a few hours. On the high peaks the mornings are usually clear, and the afternoons and nights wet.

R. DeC. Ward

PHYSICAL GEOGRAPHY

Long-Range Weather Forecasting and Ocean Temperature. Long before the days of synoptic weather maps, the relation of current meteorological conditions to rising and falling pressure was known. Later, when daily weather maps were available for study, the control of the migratory areas of low and high barometer over wind and weather changes could be worked out in great detail, and modern forecasting, for short intervals of a day or two in advance, became possible. Finally, during the last decade or so, it has become clear that the general character of *seasonal* weather is largely determined by the more or less permanent ''centers of action'' of the atmosphere, i. e. the stationary low and high pressure areas which persist for months over continents and especially over the oceans. Thus the possibility of making long-range, or seasonal, weather forecasts has stimulated an intensive study of the controls, and the influences, of these great centers of action. To this discussion, Petterson, Meinardus, Petersen, Helland-Hansen, Nansen, and others have contributed.

In this country, Dr. Charles F. Brooks of the Weather Bureau has lately been giving attention to the same subjects (see also paper by Dr. G. F. McEwen reviewed in the July *Review*, p. 72). In a recent paper (*Monthly Weather Rev.*, Nov., 1918, pp. 510-512), Dr. Brooks asserts that if it is possible to forecast the distribution of surface water temperature a few weeks in advance, it may prove possible to forecast the general paths which will be followed by cyclones and anticyclones, and then, from the winds which will result, to make long-range forecasts of the general weather to be expected in any period. In the first place, departures from the normal of the temperatures of the ocean surface result almost wholly from variations in wind direction and velocity. This point has recently been made clear by Helland-Hansen and Nansen for the middle latitudes of the North Atlantic. Here the emphasis is laid on the importance of the wind *direction* control. In the tropics the control of sea surface temperatures is found in wind *velocity*, changes in direction being of little or no importance. A considerable plus departure of temperature, originating in the eastern Atlantic during a month of stormy trades, may be felt, eight to ten months later, off the western coast of Europe.

Secondly, the paths and the intensities of migratory cyclones and anticyclones are well known to be influenced, to a considerable extent, by the temperatures of the regions over which they travel. Thus J. Petersen has shown that the Iceland low moves to and fro between southern Greenland and the Norwegian Sea under the control of a changing distribution of water temperatures induced by its own winds.

Finally, if the probable position and intensity of the center of action can be predicted, the weather type which will result may also, in a general way, be forecast. Dr. Brooks notes that ''an unusually warm Gulf Stream favors cold weather in the eastern United States, while a cool Gulf Stream favors warm weather.'' The unusually cold and snowy north and northeast winds which characterized the winter of 1915-16 in the Middle and North Atlantic States are ascribed to the unusually warm water which came through the Straits of Florida and, spreading over the Atlantic to the south and east of New England, produced very favorable conditions for cyclones in that region.

In the same number of the *Monthly Weather Review* possible applications to the North Pacific Region are briefly considered, and there is also an ''open letter,'' by Professors W. E. Ritter and G. F. McEwen, on ''Ocean Temperatures and Seasonal Weather in Southern California.'' Observations at La Jolla, Cal., show that in July-October, 1917, the ocean temperature averaged about 5°F. higher than for the same months of the preceding nine years and that the force of the northwest ocean wind for the same period was about 20 to 30 per cent below the average. These exceptional water and wind conditions were followed by exceptional winter weather. Hardly any rain fell till January, 1918, and precipitation as a whole was low for all of California.

R. DeC. Ward

HUMAN GEOGRAPHY

Natural Regions, Geographical Regions, Human Regions. The systems of classification of world regions are significant of the trend of modern geographical thought. It is nearly fifteen years since Herbertson raised a geographical landmark in his "Major Natural Regions." The subsequent trend has been signalized by Unstead in his paper "A Synthetic Method of Determining Geographical Regions" (*Geogr. Journ.*, Vol. 48, 1916). Herein he urges the delimitation of *geographical* regions, "taking into account the human equally with the physical factors." From the discussion following the paper it is, however, apparent that, while the importance of the human factor is appreciated, there is vagueness as to how the problem of interpreting it should be approached. More recently an interpretation has been offered by Dr. H. J. Fleure in "Régions humaines" (*Annales de Géographie*, May, 1917) and in a revision, "Human Regions," in the March, 1919, number of the *Scottish Geographical Magazine*. To appreciate this system of classification we must recall Dr. Fleure's conception of human geography, a conception to which attention has already been called in the *Review* (see Vol. 6, 1918, pp. 515-516). Preparatory to outlining the classification it will be well to quote a restatement of the fundamental idea. ". . . . the continuous interaction and interpenetration of man and environment and the cumulative alteration of both man and the earth with the unfolding of history. Anthropology, history, and geography are a trilogy to be torn asunder only with severe loss of truth and of value to mankind."

Following this exposition Dr. Fleure lays down the postulate that man's activities are directed toward the accomplishment of three essential functions, viz. "nutrition, reproduction, and the increase of well-being; or life, new life, and good life." The first two, "since without those a race would disappear," are at once discarded. The third function remains as a basis for distinctions between human communities. Regions are then classified according to the measure of the earth's response to man's efforts in the pursuit of well-being.

From the viewpoint of man's search after well-being the lands that yield small return even to excessive effort are classed as "Regions of Hunger." These are represented by desert and polar districts, where even the greatest exertions barely suffice to satisfy the stern demand for food. "Regions of Debilitation" are those where enervating equatorial heat and humidity combine with the never-tiring attack of tropical vegetation to check all progress beyond the securing of the mere necessities of life. These moist, warm lands of low latitudes are not the home of ease and effortless luxury but rather are regions of excessive difficulty.

"Regions of Increment" is the term used to designate those lands which encourage man and give a generous response to his efforts. Proper alternation of rain and sun is one of the chief factors in making them favorable for human occupation. Monsoonal lands and those that, like the Mediterranean countries, receive winter rain and summer sun are typical of this class. These Regions of Increment, while requiring effort on man's part, reward him with such liberality as to leave him a surplus of food and time. Hence he may devote a part of his energy toward obtaining the higher things of life. Here arts and sciences may thrive, and man early attains an advanced degree of culture. Increasing demands with the higher standards of living that accompany developing civilization have bereft some former Regions of Increment of their character as such, reducing them to lower categories.

Intermediate types are styled "Regions of Effort," where the initial task of subduing nature is great but the effort yields fruitful result, and "Regions of Difficulty," in which material fruits are likely to be small at best. In the former the natural resources must be exploited to the fullest extent, and the search for earth's treasures of field and mine brings returns that often surpass the yield in Regions of Increment. Northern France, the British Isles, Germany, and most of the United States are typical examples of the Regions of Effort, while Regions of Difficulty are found in the high valleys of temperate zones and on the plateaus with cold winters. In these latter regions little can be done toward cultivating the so-called "good life."

The age of industry has transformed certain regions of several different types into one which stands alone, especially as regards the activities of man. This is the "Industrialized Region," represented by the great manufacturing centers of the modern world, where machinery and finance, both on enormous scale, have modified man's relation to his environment.

The final type is "Regions of Wandering," where herding and hunting are the primary forms of human activity. The influence of such regions upon civilization has been out of all proportion to their sparse population or their scanty resources. Proud, thoughtful, reverent, with a bent toward trade, the nomads, in their wanderings, have spread learning, religion, and commerce in many directions from their undependable pasture lands, thus contributing toward the ''good life'' of other districts, though their own lands are doomed to remain (save for the possible intervention of man's transforming genius) the temporary abode of vagrant tribes.

Regarding the classification two points remain for special comment. In this day of drawing of new boundaries they are points whose vital importance cannot be overemphasized. As Fawcett remarks in his able essay ''Frontiers,'' the conception of frontiers as lines is purely subjective. It is convenient to establish a line boundary, but the actual bounds of human (as other) regions are *zones,* not *lines.* Here is a thought for political geography. On the largest scale considerable regions must be regarded as having a transitional character, and for this reason such regions are frequently of great import—the Paris Basin may be so considered as a transition between the Regions of Increment and Effort. In the second place the character of regions is liable to change. The modern Industrial Region is an example. Hydro-electrical development promises to transform certain Regions of Difficulty, and irrigation to redeem parts of the Regions of Wandering. Human relations must prepare for adjustment to transitions in time as well as in place.

Meteorology and Aviation. In the haste of preparation during the war most, if not at the start all, the teaching of meteorology at our military and naval aeronautical ''ground schools'' was given by men who had had no experience in flying. This was as inevitable as it was unfortunate. The instruction was naturally very largely theoretical and lacked the element of personal conviction and experience which would have done much to impress the essential facts upon the minds and memories of the young men who had enlisted in the air service.

Now that the war emergency is over and the development of peace-time commercial flying is rapidly gaining in importance, the next step is to match up the experience of the men who have actually done the flying with the theories, as these latter are now generally accepted among meteorologists. One of the earliest contributions to this discussion is that by Dr. Charles F. Brooks and others entitled ''Effects of Winds and Other Weather Conditions on the Flight of Airplanes'' (*Monthly Weather Rev.*, August, 1919, pp. 523-532). In this paper an attempt is made to explain on a scientific basis, for the benefit of the aviator, various meteorological phenomena which have actually been observed during the flying experience of numerous individuals. A further object is to bring together, from these experiences, a body of fact which will amplify, as well as clarify, the knowledge which meteorologists now possess regarding conditions in the free air. The special subjects dealt with are surface winds and local convectional currents, ''turbulent wind boundaries,'' clouds and rain, thunderstorms, and air-density changes as affecting support. Several cloud pictures and a series of diagrams illustrate the article, the usefulness of which is further increased by the inclusion of a good working bibliography.

In the same number of the *Monthly Weather Review* there are additional papers on the same general subject: by C. L. Meisinger, ''Balloon Race from Fort Omaha Through Thunderstorms'' and ''The Constant-Elevation Free-Balloon Flights from Fort Omaha''; and, by W. R. Gregg, ''The Trans-Atlantic Flight of the British Dirigible *R 34.*''

R. DEC. WARD

GEOGRAPHICAL NEWS

PERSONAL

THE DUKE OF THE ABRUZZI left Naples in October on an expedition to discover the sources of the Webi Shebeli River, which flows from Abyssinia through Italian Somaliland into the Indian Ocean.

PROFESSOR ELIOT BLACKWELDER in June resigned his position as professor of geology at the University of Illinois and since September has been devoting his time to geological research, especially regarding the history of the Rocky Mountains, with headquarters at Denver.

MR. CHARLES J. BLANCHARD of the U. S. Reclamation Service gave a series of three lectures in October and November entitled ''The Northwest''; ''Our Inland Empire''; ''The New South.'' These were given in the system of public lectures conducted under the auspices of the Board of Education of the City of New York.

DR. LOUIS BLARINGHEM, professor of agricultural biology at the Sorbonne and exchange professor at Harvard University for 1918-19, gave a series of ten lectures in French in April and May on the condition and future of agriculture in France. The subject of the first lecture was ''The Surface of France: Soils and Climatic Types.''

Major William Bowie, chief of the Division of Geodesy, U. S. Coast and Geodetic Survey, received the honorary degree of Doctor of Science at the commencement of Trinity College last June.

Professor J. C. Branner recently purchased the seismological library of Count F. de Montessus de Ballore, the eminent French seismologist, latterly director of the Seismological Service of Chile, and presented it to Stanford University. This is probably one of the most complete collections of seismological literature in existence.

Dr. James Henry Breasted, professor of Egyptology and Oriental history at the University of Chicago, spoke before the National Academy of Sciences at Washington on April 28 on ''The Origin of Civilization—from the Old Stone Age to the Dawn of Civilization.''

Professor J. W. Crook of Amherst College gave a lecture on ''Foreign Trade and Our New Merchant Marine'' on October 31 in the system of public lectures given under the auspices of the Board of Education of the City of New York.

Professor Jovan Cvijić of the University of Belgrade was awarded the Médaille Gauthiot by the Société de Géographie Commerciale de Paris in recognition of his pre-eminent knowledge of Balkan geography, both physical and human, the most recent exposition of which is his admirable ''La Péninsule Balkanique: Géographie Humaine.''

Professor W. M. Davis was awarded the Patron's Medal of the Royal Geographical Society in June ''for his eminence in the development of physical geography.''

Mr. Frank Debenham, a member of the scientific staff of Scott's last Antarctic expedition, has been appointed lecturer in surveying and cartography at Cambridge University.

Mr. Edward J. Foyles read a paper on ''The Practical Use of War Maps at the Front'' before the Section of Geology and Mineralogy of the New York Academy of Sciences on October 20.

Mr. Hoyt S. Gale of the U. S. Geological Survey, who spent several months investigating the potash resources of Europe for the Department of the Interior, made a study of the deposits of Alsace and of Stassfurt, Germany, during his stay abroad in 1919.

Professor Patrick Geddes has recently been appointed professor of sociology and civics in the University of Bombay. He has also undertaken to draw up plans for the restoration of the city of Jerusalem. Professor Geddes is the chief exponent of a movement in what may be termed geographical civics, the center of which is located in the so-called Outlook Tower at Edinburgh (cf. his article ''Beginnings of a Survey of Edinburgh,'' *Scottish Geogr. Mag.*, Vol. 35, 1919, No. 8).

Professor Mark Jefferson gave a series of five lectures on the peace conference at the summer session of the State Normal College at Ypsilanti, Michigan. Professor Jefferson was chief of the Division of Geography of the American Commission to Negotiate Peace at Paris and representative of the United States on the commission of geographical experts of the Great Powers for the study of boundaries, from December, 1918, to July, 1919.

Mr. H. J. Mackinder, the eminent British geographer and member of Parliament, was in November appointed British High Commissioner for Southern Russia.

Mr. F. E. Matthes of the U. S. Geological Survey gave a series of lectures in the Yosemite National Park during July under the auspices of the University Extension Division of the University of California. The subjects were as follows: ''Origin of Yosemite Valley as Indicated in the History of the Waterfalls''; ''The Highest Ice Flood in the Yosemite Valley''; ''The Origin of the Granite Domes of Yosemite.''

Mr. J. T. Nichols read a paper before the New York Academy of Sciences on May 12 on ''The Relation of Ocean Currents to Fish Faunae in the Atlantic.''

Dr. Francis Rolt-Wheeler, in the system of public lectures conducted under the auspices of the Board of Education of the City of New York, gave a number of lectures in October and November dealing with the activities of government bureaus. The bureaus discussed were the Geological Survey, Forest Service, Reclamation Service, Department of Agriculture, Department of the Interior, Indian Affairs Office, Bureau of Fisheries, Emigration Office, and Census Bureau.

Professor G. B. Roorbach, recently of the University of Pennsylvania, has been appointed to fill the newly created chair of foreign trade at the Graduate School of Business Administration at Harvard University.

Dr. J. N. Rose of the National Museum, Washington, D. C., spoke before the Torrey Botanical Club on April 8 on "Botanical Explorations in Ecuador."

Dr. H. J. Spinden of the American Museum of Natural History addressed the New York Academy of Sciences on April 21 on "The Eruption of a San Salvador Volcano, June 7, 1917."

Mr. Vilhjálmur Stefánsson was recently awarded the La Roquette gold medal of the Société de Géographie de Paris in recognition of discoveries made by the Canadian Arctic Expedition under his command during the years 1913-18.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

ASIA

India

Creagh, O'Moore. **Indian Studies.** 320 pp. Hutchinson & Co., London, 1918. 16s. 8½ x 5½.

This is a modest volume, without preface, dedication, introduction, map, or even index. The 17 chapters are most meagerly labeled, and the hasty reader is repelled by the little that is done to attract his attention and inflame a jaded curiosity. The book is characteristic of its author—soldier from boyhood, a doer of deeds rather than a maker of phrases, a blunt critic, a patriot who despises the traitor disguised as a friend of humanity. No one knows India better than General Creagh; no white man has lived there longer; and none experienced more varied fortunes amid her 400,000,000 souls of differing race and creed. From subaltern to commander in chief, the author has studied India at first hand and, now that he is in official retirement, has penned a precious legacy for the guidance of those about to experiment politically in this vast and complicated empire.

The name and rank of Sir O'Moore Creagh suggest involuntary comparison with Lord Roberts—a comparison useful only in so far as it draws attention to the high standard of personal talent and loyal service prevailing in the Indian army. Lord Roberts' book is about himself—primarily a biography and incidentally valuable as a guide in Far Eastern problems. Creagh's book takes each phase of British India seriatim, and we are left to guess regarding the author, who gives us no clue save the negative one by which every reader will recognize the hand of a morbidly modest writer.

The book treats of Hindus, Mussulmans, Sikhs, the India Office, local government, the land tax, the village, feudatory states, the army in India, and the British government and its dealings with India.

It is nine years since the reviewer was in Calcutta, but he well remembers that the name of Creagh evoked from native soldiers a loyal response, not to say reverence, that recalled such names as Lawrence and Nicholson. Let this indicate the degree of sympathy with which the author approaches his subject.

He has no academic prejudices or theories to apply. He knows the Sikh and the baboo, the Pathan, the Bengali and the warlike Mussulman of the north, the smooth banian, and the rapacious Brahman. He has little to say about native councils, or leagues of nations. He sees the need for honest and firm government by honest and firm administrators.

The Mesopotamia disaster is traced directly to the same pacifist policy that led the Third Napoleon to Sedan. "There was no co-ordination of work (p. 249) . . . . There were no plans of campaign worked out in time of peace; no mobilization arrangements were made until war was in sight; no useful intelligence regarding a probable enemy was collected . . . . The state of the army itself (in India) was due to a régime of pacifists who refused funds to keep it efficient and treated the repeated warnings of myself and my staff with scorn."

Here is enough to assure the reader that we have under consideration no smooth diplomatic apology for official incompetence but the indignant protest of a patriot who loves his country no less than he does India and who believes that she has the strength to throw off the red-tape leeches that are sucking her blood and that she will be the better for such an effort, even though he may personally be made a target for abuse by those whom he exposes in these pages. Aside from its great importance to students of administration, this volume is an arsenal of important notes, ethnological, geographical, sociological, and religious.

Poultney Bigelow

Harwood, W. A. **A discussion of the anemographic observations recorded at Deesa from January 1879 to December 1904. A discussion of the anemographic observations recorded at Karachi from January 1873 to December 1894.** With an introduction by G. T. Walker. Diagrs. *Memoirs Indian Meteorol. Dept.*, Vol. 19, pp. 275-335. Calcutta, 1915.

Sir John Eliot, who was formerly at the head of the Meteorological Service of India, planned to write, after his retirement, a set of memoirs dealing with the wind records at several Indian stations. His death prevented the completion of this work by himself, and Sir Gilbert Walker, the present Director General of Indian Observatories, has very wisely carried the series to completion, in the *Memoirs of the Indian Meteorological Department.* The present volume deals with the wind records for Deesa and Karachi, and was prepared by Mr. W. A. Harwood, Assistant Director of the Aerological Observatory at Agra. Sir John Eliot, however, left some notes for the Deesa investigation. Deesa is in latitude 24° 14′ N., longitude 72° 13′ E., and is situated on a sandy plain, extending eastward from the Rann of Cutch to the Aravalli Hills, about 60 miles from the Rann and over 200 miles from the open sea to the west of Cutch. The records cover the period January, 1879, to December, 1904. The year is divided into the three seasons characteristic of northern India viz. cool, hot, and rainy. Each season has its characteristic winds, and the data are considered under these three heads. In the cool season Deesa is within the zone affected by the ''cold weather storms'' of northern India, which come from Baluchistan and move eastward across the country.

Karachi is on the Sind coast at the extreme northwestern end of the Indus delta. The data cover the period January, 1873, to December, 1894. The three seasons are cool, hot, and monsoon. Three types of storms affect Karachi, viz. winter storms, moving eastward into India; monsoon storms moving westward from the Bay of Bengal; and storms of the transition periods, occasionally entering India from the Arabian Sea.

The discussion of the wind records is remarkably complete. The wind roses show very clearly the seasonal variation in wind direction at Deesa and the prevalence of winds from westerly and southerly points at Karachi, except in December and January. Many other diagrams are also included. This volume, like the long line of its predecessors, is in every way worthy of the splendid traditions of the Meteorological Department of India. R. DeC. Ward

Gouldsbury, C. E. **Tigerland: Reminiscences of forty years' sport and adventure in Bengal.** New edit. xvii and 262 pp.; ills. E. P. Dutton & Co., New York, 1916. $1.25. 8 x 5.

Hayden, H. H. **The mineral production of India during 1917.** *Records Geol. Survey of India,* Vol. 49, 1918, Part II, pp. 55-116. Calcutta.

Minchinton, H. D. **Himalayan scrambles in 1914.** Ills. *Alpine Journ.,* No. 214, Vol. 31, 1917, pp. 51-70. London.

Queyroz, Fernaõ de. **Conquista temporal e espiritual de Ceylaõ.** Introduction by P. E. Pieris. xxx and 994 pp. Government of Ceylon, Colombo, 1916. 10 x 6. [A reprint, from a manuscript copy purchased in 1844 from the Instituto Historico of Rio de Janeiro and now in the possession of the Government of Ceylon, of this fundamental source on the history of Ceylon, completed in 1687 by the author, then Provincial in the Society of Jesus.]

Stuart, Murray. **Preliminary note on the Srimangal earthquake of July 8th, 1918.** Maps. *Records Geol. Survey of India,* Vol. 49, 1918, Part III, pp. 173-189. Calcutta.

Younghusband, Francis. **Geographical work in India for this** [i. e. Royal Geographical] **Society.** Ills. *Geogr. Journ.,* Vol. 49, 1917, No. 6, pp. 401-418.

—— ***India and adjacent countries.*** 1:1,000,000. (1) Layered edit. and (2) political edit.: Sheets ***10, 17, 24, 29, 33, 39, 41, 43, 52, 53, 56, 58, part of 49, 62, 63, 64***; layered and shaded edition only: Sheet **25.** Survey of India, Calcutta, 1915, 1916.

—— ***India, showing railways, open and under construction on 31-3-18.*** 1:4,055,040, or 1 in. to 64 miles. Survey of India, Calcutta, 1918. [Different gages and number of tracks shown by means of 11 symbols.]

—— [***Topographic map of India.***] 1:126,720. Sheets: ***43 B/S.W.; 43 B/S.E.; 43 C/S.E.; 47 M/N.W.; 47 M N.E.; 47 M S.E.; 49 M/N.E.; 49 N N.E.; 53 B S.E.; 53 H/N.W.; 53 H/S.E.; 55 M S.E.; 56 A S.W.; 58 A S.W.; 58 A/N.W.; 58 A/N.E.; 73 B/S.W.; 92 G/S.E.; 92 H S.E.; 92 H S.W.; 92 H N.W.*** Survey of India, Calcutta, 1916, 1917.

—— [***Topographic map of India.***] 1:253,440. Layered edit.: Sheets ***38N, Afghanistan and N.W. Frontier Province; 43D, Punjab; 84L, Burma; 92H, Burma.*** Political edit.: Sheets ***38N, Afghanistan and N.W. Frontier Province; 43C, Punjab and N.W. Frontier Province; 43D, Punjab; 84L, Burma; 92H, Burma.*** Survey of India, Calcutta, 1915, 1916.

AUSTRALASIA AND OCEANIA

MELANESIA, MICRONESIA, POLYNESIA

BURGESS, P. S. **A study of the principal plantation soil types as found on the Island of Hawaii.** 100 pp.; map, diagrs. *Rept. of Work of Exper. Sta. Hawaiian Sugar Planters' Assoc., Agric. and Chem. Ser. Bull. No. 45.* Honolulu, 1917.

DAVIS, W. M. **Les falaises et les récifs coralliens de Tahiti.** Diagrs. *Ann. de Géogr.*, No. 148-149, Vol. 27, 1918, pp. 241-284.

FORNANDER, ABRAHAM, AND T. G. THRUM. **The Hawaiians' account of the formation of their islands and origin of their race, with the traditions of their migrations, etc., as gathered from original sources.** (Fornander Collection of Hawaiian Antiquities and Folk-Lore.) iv and 228-503 pp. *Memoirs Bernice Pauahi Bishop Museum*, Vol. 5, Part II, pp. 228-503. Honolulu, 1919.

FOYE, W. G. **Geological observations in Fiji.** 145 pp.; maps, diagrs., ills., bibliogr. *Proc. Amer. Acad. of Arts and Sci.*, Vol. 54, 1918, No. 1. (Shaler Memorial Ser.) Boston.

HAMRICK, A. M. **Cumulus clouds of Hawaii.** Diagr., ills. *Monthly Weather Rev.*, Vol. 46, 1918, No. 9, pp. 415-417.

REPELIN, J. **Sur un point de l'histoire de l'océan Pacifique.** *Comptes Rendus de l'Acad. des Sci.* [*de Paris*], Vol. 168, 1919, No. 4, pp. 237-239. [The author believes that geological evidence points to the former existence of a continental land mass which included the Pacific islands from Fiji to the Low Archipelago.]

—— ***Hawaii.*** [1:250,000.] U. S. Coast and Geodetic Survey Chart No. 4115. Washington, D. C., Feb., 1919.

POLAR REGIONS

GENERAL

GREELY, A. W. **Terrestrial life in Polar environments.** Ills. *Amer. Museum Journ.*, Vol. 17, 1917, No. 8, pp. 547-550.

HASSERT, KURT. **Die Polarforschung. Geschichte der Entdeckungsreisen zum Nord- und Südpol von den ältesten Zeiten bis zur Gegenwart.** (Ser. Aus Natur und Geisteswelt.) 3rd edit. 134 pp.; maps, index. B. G. Teubner, Leipzig, 1914. M. 1.25. 7½ x 5.

HOBBS, W. H. **The Ferrel doctrine of Polar calms and its disproof in recent observations.** *Proc. 2nd Pan American Sci. Congress, Dec. 27, 1915 to Jan. 8, 1916*, Vol. 2, Section 2: Astronomy, Meteorology, Seismology, pp. 179-189 (discussion, pp. 187-189). Washington, D. C., 1917. [Author's abstract is published in the *Monthly Weather Rev.*, Vol. 43, 1915, No. 12, p. 609.]

TOLMAČEV, J. P. **Notice sur la création de une** [*sic*] **commission polaire permanente.** *Bull. de l'Acad. Imp. des Sci.* [*de Pétrograd*], Ser. 6, 1915, No. 6, pp. 467-481. [In Russian.]

VERNADSKIJ, V. J. **Notice sur les buts de la commission polaire.** *Bull. de l'Acad. Imp. des Sci.* [*de Pétrograd*], Ser. 6, 1915, No. 6, pp. 481-484. [In Russian: supplementary to the note by Tolmatchev, listed above.]

ARCTIC

DE GEER, GERARD. **On the physiographical evolution of Spitzbergen.** Map, diagrs. *Geogr. Annaler*, Vol. 1, 1919, No. 2, pp. 161-192. Stockholm.

This paper is a valuable summary of a structurally and physiographically complicated region by an experienced observer; but the method of presentation is such that much work is left for the reader before he can clearly understand the writer's meaning. ''Physiographical evolution'' is here practically synonymous with ''geographical evolution,'' in the special sense used by Sir Archibald Geikie in a famous lecture on Scotland some years ago; for both phrases mean the geological history of the physiographical features that the region has manifested through its long development. Hence, although both essays were published in geographical periodicals, the summary, like the lecture, contains much that is geographically irrelevant, except in so far as it may be useful for geography, a present-day subject, to consider how far the processes and conditions of past ages were similar to those of the existing era.

The difficulty in reading De Geer's text is one that is frequently encountered in the geological treatment of physiographic problems. It arises chiefly from the failure to make explicit statement concerning the physiography of the land mass that was deformed and concerning the changes that took place upon it after deformation, at different stages in the region's history. The failure to make these statements does not appear to be so much because the past land forms of Spitsbergen are known to the author, as because he has not recognized their essential importance in a physiographic description. The essence of such a description is that it treats surface forms as well as underground structures. Hence, however full the understructure of a mass may be explained, its physiographic treatment is not complete until the form of its surface is indicated. For example, a ''great flexure'' is said to form the southern limit of the ''northern oldland of Spitzbergen''; but the form of the thing that was flexed is not described; hence the flexure cannot be visualized as a physiographic element in the evolution of the region. Again, a ''great horst,'' which forms part of the western coast and which is said to be of ''very ancient origin,'' was upheaved at a later date; but in absence of all indications of its form at the time of upheaval, no clear concept can be gained as to the physiography of the upheaved area at that stage in Spitsbergen's evolution.

When the later stages of evolution are reached, the problem is less involved and more fully presented; and at the same time the problem becomes more geographic in its nature. Long-continued erosion resulted in the reduction of the region to a ''base level'' or peneplain in Cretaceous time; the peneplain was at least in part depressed and covered with 1200 meters of Tertiary strata; the compound mass was broken into blocks with roughly north-south trend in late Tertiary time, and the blocks were differentially displaced with moderate tilting; except that along the eastern border of the western horst, the Tertiary strata were strongly folded and faulted, the folds being adjusted to the great flexure of the northern oldland, which adjoins on the east, as ''billows are to a shore.'' This is easily followed; but a lapse of explanation then happens; for, as is so often the case in the geological treatment of physiographic problems, practically no attention is given to the erosion by which the folded and faulted strata have been carved into their present form of sub-parallel ridges and valleys, although the accompanying sections show that an enormous volume of material must have been carried away in the reduction of the folded mass to its actual form.

The present altitude of the displaced peneplain blocks (whether formerly covered by Tertiaries and then stripped, or never covered, is not made clear) is indicated on the map by 200-meter contours and color tints, the greatest altitudes being 1200 meters. The contours are taken to represent fairly well the deformation that the region has suffered, on the reasonable assumption that the peneplain lay, before it was deformed, not much above sea level. Many of the blocks are gently tilted. Some are believed to have been warped into a convex surface: this is inferred because around the block margins, now much dissected by short fiord branches, the spurs here and there retain upland surfaces that are taken to represent the peneplain, although they are at significantly lower levels than those of the block axis. But it is recognized that it is not always possible ''to know how much the present mountain tops have been lowered [by erosion] from the original base-level plain.''

Spitsbergen is said to offer ''unrivalled opportunities for fruitful and probably conclusive studies as to the origin of fjords.'' The last dislocations by which the Cretaceous peneplain ''was broken and deformed . . . show undoubtedly . . . . a very close connection with the formation of the leading recent land forms [upland blocks and intermediate troughs] and especially with the main fjord and fjord-valleys.'' The head branches of Ice Fiord in particular exhibit deformed structures that prove the branches to be ''determined by fissures and dislocations''; thus an intimate relation is found between ''the mountain-making and the fjord-formation.'' Dissent must be expressed from this confident conclusion because, as in the account of the mountain ridges of folded Tertiary strata, the part played by erosion is not sufficiently considered. True, a paragraph on a later page, which opens with a repetition of the above conclusion: ''It seems obvious that concerning the fjord- and valley-formation in Spitzbergen the late Tertiary dislocations and fissures played by far the most important rôle,'' closes with the supplementary statement: ''It is evident that later erosion and finally the glaciers have given the last touch to the work:'' but the very subordinate part thus ascribed to erosion by no means meets the facts as they are presented in the sections. Clearly, the structure of the region was given by the Tertiary dislocations; but the actual fiords, like the visible ridges of the folded Tertiary strata, are the work of erosion. The erosion appears to have been largely consequent upon the uneven form of the surface, as produced by the dislocations; but the fiords as physiographic features of today are the products of an erosion so great that its measure should not be reduced to a "last touch," and its mention should not be relegated to a late paragraph.

The present reviewer is the more inclined to dissent from the above-quoted statements as to the origin of the Spitsbergen fiords because the statements are supported by reference to the "numerous indubitable fault-steps in southern and middle Sweden," which are also regarded as the result of deformation, not significantly modified by erosion. Yet observation on the ground, as well as a study of detailed topographic and geological maps of that interesting region, gives good reason for believing that these steps are not fault scarps, in the sense of being in the main directly due to faulting and only slightly modified by later erosion, but are resequent fault-line scarps, in the sense of being due wholly to the action of erosion on a faulted mass, the original displacements of which took place so long ago that after the broken surface was baseleveled a regional elevation permitted the excavation of the weaker strata on one side of the fault lines, thereby leaving the stronger crystalline rocks on the other side in the form of somewhat battered and dissected scarps, the height of which does not necessarily bear a close relation to the throw of the original faults. Swedish geologists who have interpreted these scarps as directly due to faulting do not seem to have considered the possibility of the alternative interpretation, much less the good reasons that support it. In view of the alternative explanation, it is permissible to believe not only that the mid-Swedish escarpments are not fault scarps but also that the Swedish school of fiord interpretation seriously underestimates the importance of erosion in producing fiords, whether the fiord region was previously deformed on fiordlike lines or not.

W. M. Davis

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WORLD AS A WHOLE AND LARGER PARTS

Breasted, J. H. **The place of the Near Orient in the career of man, and the task of the American Orientalist.** *Journ. Amer. Oriental Soc.*, Vol. 39, 1919, Part 3, pp. 159-184.

This address marks a new point of departure in the study of history and of historical geography.

In the first place Professor Breasted insists upon the necessity of comparative study in history. This he demonstrates convincingly by a comparison of the two areas on the globe in which alone man has risen from Stone Age savagery to the possession of agriculture, metals, and writing. One of these is in the New World, and the leaders in this region were the Mayas of Yucatan, the Nahuas of Mexico, and the Incas of Peru. The other is in the Old World, and the leaders there were the peoples of the Nile and the Euphrates valleys. Each of these regions lies along, or on both sides of, a great intercontinental bridge, one joining the two Americas, the other connecting Africa and Eurasia.

In the second part of his paper Professor Breasted urges the imperative need for considering every phase of evidence in the study of man. Hitherto historians have been content to restrict themselves to the evidence of written documents. Hereafter they must be prepared to utilize the data supplied by archeology, prehistoric remains, physical anthropology, botany, agriculture, animal life and domestication, geology and paleontology, hydrography.

The fact is that departments, not only of Oriental studies, but of the "humanities" in general are built up on the model of a traditional department of Greek or Latin organized to teach languages. In the presence of modern problems such an arrangement is futile: we must begin to study *man* and not a branch of "polite" learning. In the new undertaking we must be prepared to consider all the available evidence, of every kind and character, that will throw light on the conditions of human life in the past.

FREDERICK J. TEGGART

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HUMAN GEOGRAPHY

General

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To the student of the influence of geographic environment this little book, which was written as an introductory chapter of a treatise on Herder's conception of *milieu,* will prove exceedingly interesting and valuable, because it brings together, in convenient form, a wealth of material not readily available to the geographer.

The book is a brief résumé of the literature of the theory of environment from the earliest writings to the present. Complete references and numerous quotations are given, many of the latter being embodied in the text. An introductory note discussing the various words used in different languages to express the idea of *milieu,* or environment, is followed by two chapters, the first sketching the history of the idea of *milieu* down to the nineteenth century, and the second continuing the history from the beginning of the nineteenth century to the present. The second chapter is not strictly chronological but is divided into topics such as ''Anthropogeography, Geography, and History''; ''Geography and History''; ''Primitive Peoples and Environment''; ''Climate and Conduct,'' etc.

As a bibliography and convenient reference work on the literature of the theory of environment, this little book will find a ready welcome. John L. Rich

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VOL. VIII DECEMBER, 1919 NO. 6

CLIMATIC CYCLES AND EVOLUTION*

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Commonwealth of Australia Bureau of Meteorology

[With separate map, Pl. V, facing p. 312.]

Introduction

It has always been admitted that climate is one of the chief factors in determining evolution. That great changes have occurred in past climates has been accepted by geologists since the dawn of the glacial controversy, if not earlier. It is only of late, however, that the possibility of important changes in recent and historic times has been carefully investigated, by Huntington, Penck, J. W. Gregory, and others.

It is the purpose of this paper to show that there have been recurring cycles of such climatic change, cycles that have exercised perhaps paramount influence on the evolution of life.

Two cycles seem to be shown in the biological and geological record. The minor cycle recurs every 200,000 years or thereabouts and has determined the duration of the four Pleistocene ice ages and also the development and migrations of the four main races of man. The major cycle is about 100,000,000 years long, and we have a record of three such major cycles since the dawn of the Cambrian Age. The minor cycles are superimposed on the major cycles in such a fashion that in each major cycle, after long ages of fairly uniform climate throughout the world, there appears a zonal arrangement of climates. This culminates at the four great ice epochs, that is in late Proterozoic, Devonian, Permian, and late Tertiary times.

The gradual change of climate through late Tertiary times is first described as it has affected Australia. This constitutes Part I of the paper. Then the effect of climate on man's ethnological characters is briefly dis-

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* All the footnote references, except 2, 5, 6, 7, 24, 26, 35, 37, 38, 40, 41, 47, have been supplied editorially. For these the author is therefore of course not responsible. Nor was it possible to send him proofs of the article for revision—EDIT. NOTE.

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cussed, and reasons are given for ignoring color as a major factor in race classification. The cephalic index and the hair, and to a lesser degree the culture of a race, are used as criteria.

A map of the world giving these characters for the primitive tribes (Pl. V) clearly indicates, as Matthew suggests,[1] that the biological center is in Asia and that all the races have migrated thence as a result of climatic thrusts. These latter were chiefly glacial at first and due to arid conditions later. Incidentally the "yellow" race is shown to have developed later than the "white."

Carrying the investigation back into earlier ages I find a similar sequence of climate for temperate regions. The four major ice ages are correlated with the striking breaks in the biological succession and with the periods of great mountain building. Evidence is given supporting the periodicity of these changes and indicating that a powerful weapon is thus placed in the hand of the geologist and biologist.

The time scale is then considered, especially in connection with radioactive experiments, and it is shown that to a certain extent it supports the cyclic hypothesis and enables us to fix absolute values for the major and minor periodic cycles.

Some suggestions as to the causes of these major and minor cycles are made. I especially wish to state, however, that, whether these suggestions be substantiated later or not, the earlier portions of the paper dealing with the periodicity of the phenomena will not be materially affected.

Part I

Late Paleoclimatology in Australia

For many years attention has been concentrated on the changes in temperature in past ages; but little has been written on the much more important feature—from the point of view of civilization—of rainfall.

The Rain Belt

In a model devised in 1912 (the solar-control model[2]) I was able to demonstrate how remarkably the continent of Australia lent itself to problems of climatology. The swing of the sun from tropic to tropic is followed by the swing of the isotherms. The latter reacts on the pressures, and the rains follow later, there being a lag of about five weeks.

From the present point of view it is important to note that the isohyets (rainfall) agree with the isotherms very remarkably. Moreover it is easy to plot the "center of aridity" month by month and relate it to the path of the sun and of the isotherms. This is shown in Figures 1 and 2. All the localities in Figure 1 are near longitude 135° E., and they show that the center of aridity moves north and south with the sun, but about four or five weeks later.

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[1] W. D. Matthew: Climate and Evolution, *Annals New York Acad. of Sci.*, Vol. 24, 1914, pp. 171-318; reference on p. 209.

[2] Griffith Taylor: The Australian Environment (Especially as Controlled by Rainfall), *Commonwealth of Australia Advisory Council of Science and Industry Memoir No. 1*, Melbourne, 1918; model inside front cover.

If we compare this belt of maximum aridity with the temperature, it is found to agree very closely with the isotherm of 75° F. In January this isotherm passes just north of the Great Australian Bight through Tarcoola (see Figs. 1 and 3). In April it passes between Oodnadatta and Daly Waters. In July it goes through Pine Creek. In fact it practically coincides with the driest place in each month, as the maps in Figure 2 demonstrate.

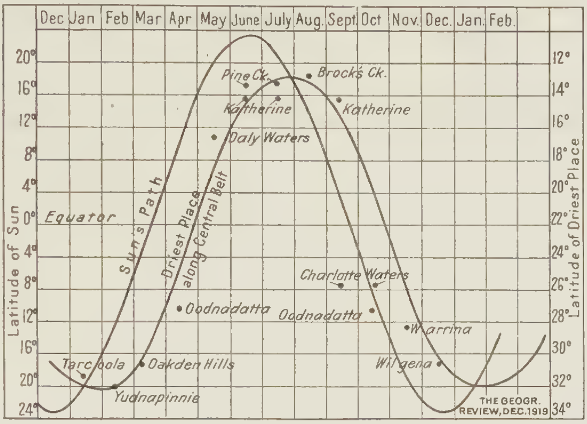


FIG. 1—Diagram showing the relation of the sun's march between the tropics to the march of the rain belt, illustrating the movement of the center of aridity across Australia. The driest spot in each month is used as index. (After Fig. 2 of the author's "The Australian Environment, Especially as Controlled by Rainfall," *Commonwealth of Australia Advisory Council of Science and Industry Memoir No. 1*, 1918.)

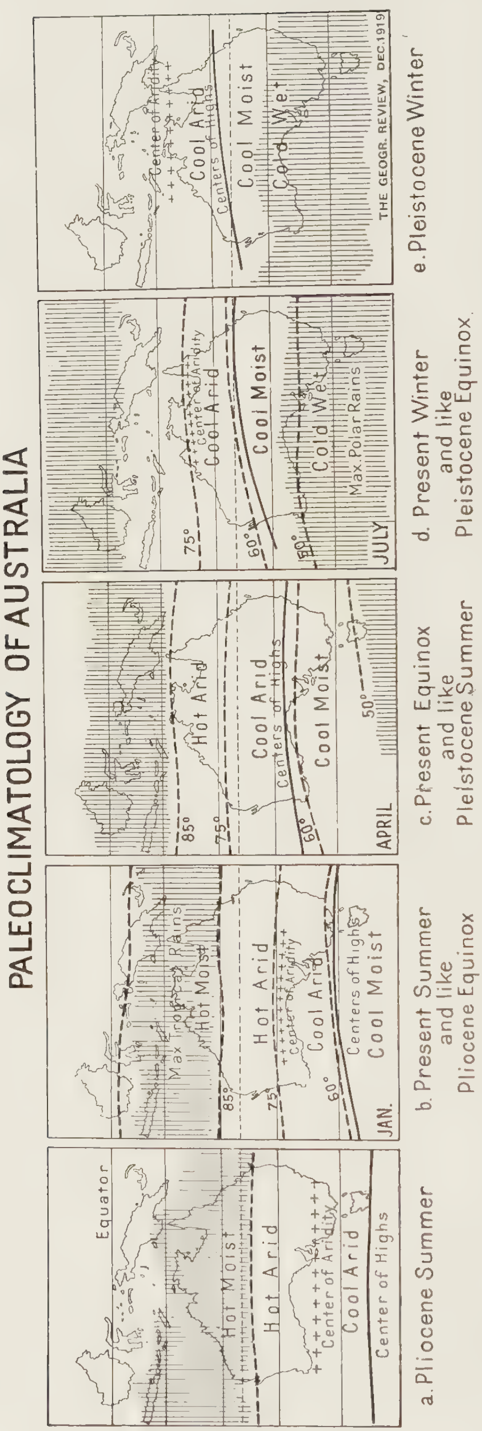
In a similar way the rain belts move *between* definite isotherms in Australia. There is no complication due to mountains or large gulfs; in fact Dame Nature has placed Australia like a blackboard on which fundamental climatic problems may be investigated.

The southern boundary of the tropical low-pressure rain belt (2-inch isohyet) agrees fairly well with the isotherm for 85° (see Fig. 2b). This isohyet defines the really heavy rains of the tropics, though of course there is some tropical rain south of the latitude concerned. The consequent hot moist climate only affects the continent for the three summer months in the tropics.

At this period (summer) central Australia has a hot arid climate, and the southern coast lands a cool arid climate. (In this discussion we are ignoring the east coast, where other factors affect the climate.) Only in Tasmania is the cool moist climate—which is that most favorable to civilized life—benefiting the land.

At the equinox (autumn, see Fig. 2c) the belts have moved north with the sun. The center of aridity (and the 75° isotherm) is now almost on the tropic. Tropical Australia is experiencing hot arid conditions, the central belt is cool and arid, the southern coast is cool and moist.

In winter the center of aridity runs through the northern coast lands



a. Pliocene Summer

b. Present Summer and like Pliocene Equinox

c. Present Equinox and like Pleistocene Summer

d. Present Winter and like Pleistocene Equinox

e. Pleistocene Winter

FIG. 2 (a to e)—Five maps showing the seasonal rain belts, Pliocene to present, in Australia. (Note—The Center of Aridity is lacking in Fig. 2c. It should lie just south of the 75° isotherm.)

(Fig. 2d), tropical Australia is largely cool and arid, the southern coast lands are cold and wet.

The Rain Belt in Pleistocene Times

Now suppose that the isotherms were all moved to the north, as would occur if the temperature of these latitudes fell, say, 5°; we should have the type of winter shown in Figure 2e. The center of aridity would coincide with Port Darwin (in winter). The whole of temperate Australia would be vastly improved in climate. Heavy rains would penetrate far north of their present limit. There would be a heavy snowfall on the Australian Alps, and glaciers would develop and reach down the valleys.

As we know, this is exactly what happened in Pleistocene times. Mt. Kosciusko shows many signs of glacial action, and a glacier three miles long and 1,000 feet thick extended down the valley of the Snowy River. At the present time only a few patches of snow exist through the summer on the sheltered eastern side of the range, though it reaches above 7,300 feet.

In Tasmania the glacial conditions were naturally more marked. I recently traced moraines which showed that in the National Park

(Mt. Field) a glacier about five miles long extended from the central range down the Broad River. Many fine cirques occur here, and also at Cradle Mountain and in the western mountains near Mt. Lyell.

As regards the lowlands in Australia there is overwhelming evidence of the happier conditions which obtained in Pleistocene times. Howchin has described[3] the course of large rivers which rivaled the present Murray and flowed south from Lake Eyre and Lake Frome.

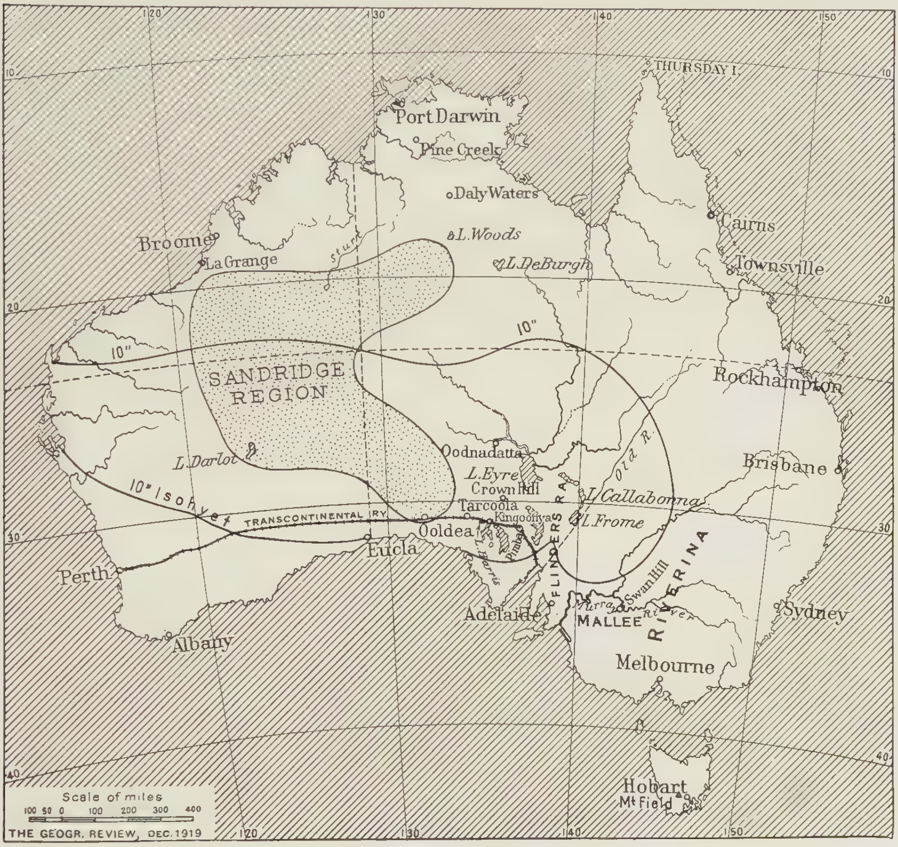


FIG. 3—Sketch map of Australia to illustrate Pleistocene conditions. Scale, 1:25,000,000.

The *Diprotodon*—a marsupial wombat as large as a rhinoceros—has been discovered in river and lake deposits throughout Australia. The most complete skeleton was obtained from the muds around Lake Callabonna (near Lake Frome; Fig. 3). But it is found near the arid Lake Darlot (Western Australia, latitude 28°) and all round Lake Eyre. It was a large herbivorous animal which certainly could not exist in a region which has only 7 inches of rain, as this region has at present. The present condition

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[3] Walter Howchin: The Geography of South Australia, Including the Northern Territory, Historical Physical, Political, and Commercial, Melbourne, 1909, pp. 123-125.

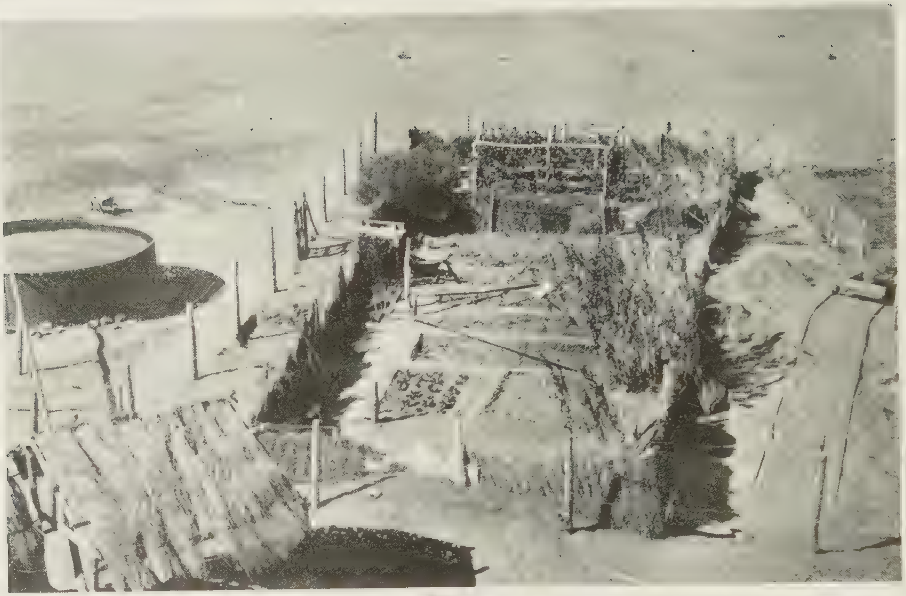

FIG. 4

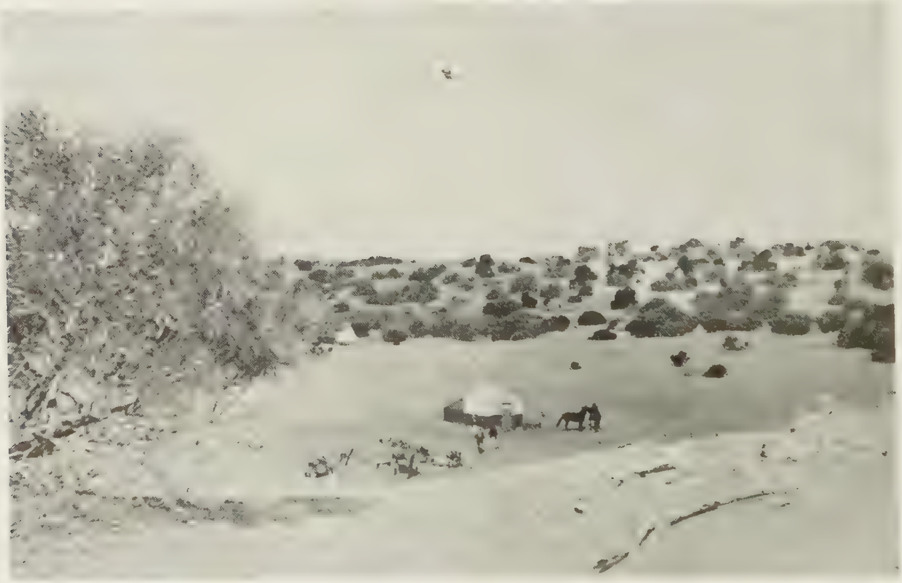

FIG. 5

FIG. 4—View of Crown Hill "oasis," South Australia, 70 miles southwest of Lake Eyre—for location, see map, Fig. 3. (Photo by the author, May 15, 1919.)

The view is taken from the windmill platform. The water is a Tertiary supply about 70 feet down. The iron tank supplies the "oasis." This is surrounded by wire netting to keep out rabbits, emus, and kangaroos. Inside this is a brushwood fence to keep out the sand drift. The latter has, however, invaded the enclosure on the north (near) side. A small tramway (of iron pipes) and an improvised wagon have been used to cart the sand to the lee side. Some vines and a few fruit trees at the back and cabbages in front can be made out. There is no permanent settlement between this "station" and the Indian Ocean at La Grange—one thousand miles to the northwest.

FIG. 5—View of Ooldea Well, South Australia, on the Transcontinental Railway, long. 132° E. (Photo by the author, May 10, 1919.)

The southern end of the great sand-ridge region in Australia, which extends to the Indian Ocean. Here is the chief water supply on the Transcontinental Railway between Kingoonya (S. A.) and West Australia. The camels indicate the native well found by Giles in 1876. The dunes are about 150 feet high and run roughly northwest. The pipe lines (seen back of the tent) carry water pumped to the railway four miles south. The vegetation is "mulga."

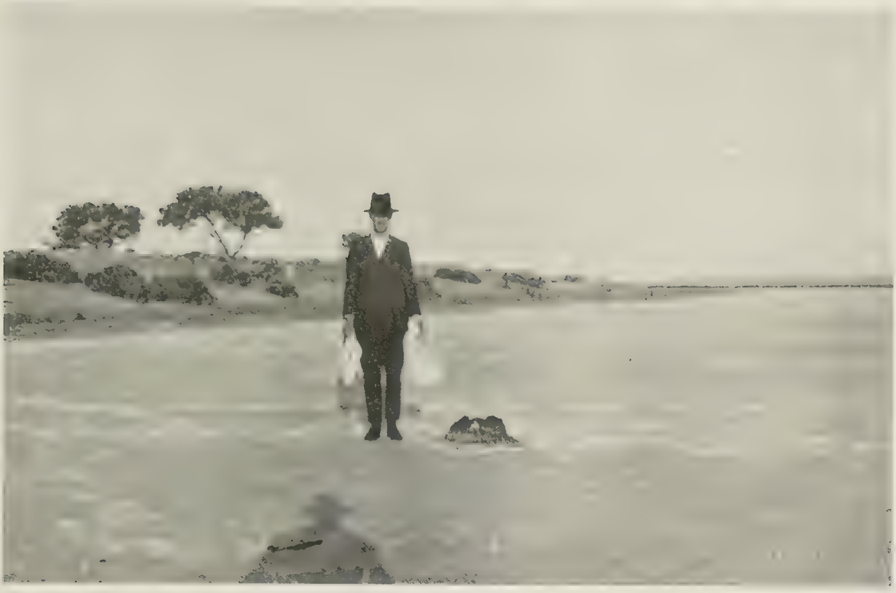

FIG. 6

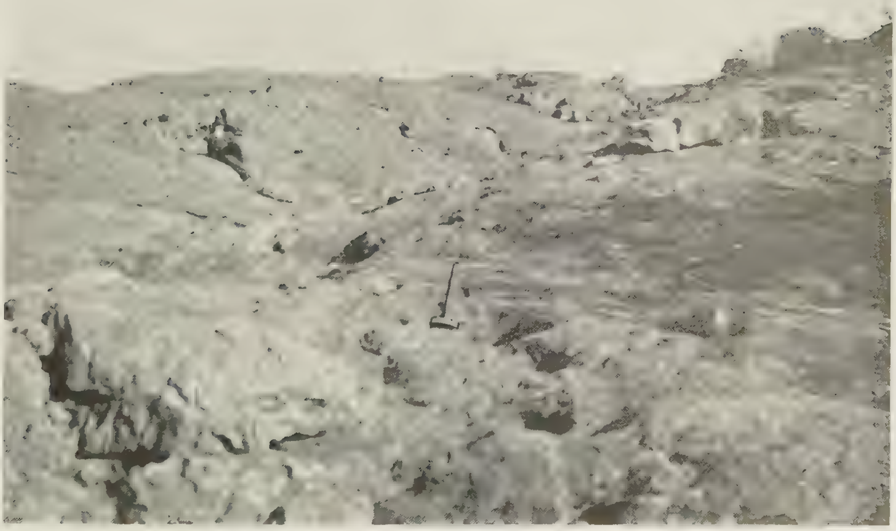

FIG. 7

FIG. 6—View of Lake Harris, a typical playa near Kingoonya, South Australia, on the Transcontinental Railway, long. 135° E. (Photo by the author, May 12, 1919.)

The man is holding slabs of salt which have crystallized on twigs. The crust is one inch thick. In the background is a fine mirage (on the right). The trees are acacias ("wattle"). This photograph was taken a stone's throw from the next.

FIG. 7—View of Tomato Rocks, Lake Harris, South Australia. (Photo by the author, May 12, 1919.)

A small gulley in a low rocky outcrop of very hard porphyry, about half a mile across. Here there is only a 7-inch rainfall per year. The numerous potholes indicate much greater rainfall in the past. These red rocks lie on the shore of Lake Harris—see Fig. 6—and rise to about 80 feet above the general level.

of this region is shown in the photograph of the Crown Hill "oasis" (Fig. 4), 70 miles southwest of Lake Eyre.

The vast alluvials of the Riverina region and western New South Wales indicate a period when numerous large rivers flowed into the Tertiary sea of the lower Murray basin. On the Victorian side of the lower Murray is the Mallee country, largely consisting of huge sand dunes which have blocked the Wimmera River and other tributaries of the Murray. The dunes are also found at Ooldea on the Transcontinental Railway and stretch almost uninterruptedly to the northwest—right to the Indian Ocean. These dunes are slowly moving south in some cases, though they are usually covered with mulga (*Acacia*), tea tree (*Leptospermum*), and dwarf eucalypts (see the photograph of Ooldea Well, Fig. 5).

It is to be noted that in 1914 the Murray, large river as it is, ceased to flow below Swan Hill. The last similar occurrence is said to have been in 1839.

The land forms tell a similar tale. All through the salt-lake district of South Australia there are preserved mature valleys which are certainly not those which would be produced by a 7-inch rainfall. Near Pimba these are especially noticeable. The salt lakes in many cases seem to be old river valleys blocked by silts rather than typical playas cut out by wind erosion. In some cases terraces are visible on the valley walls, but no detailed investigations have yet been made. Many of the small rock outcrops contain short gullies with all the characters of a pluvial cycle. The potholes at Tomato Rocks (cut in hard feldspar-porphyry), only a stone's throw from the salt expanse of the playa Lake Harris, offer an interesting illustration of climatic change (see Figs. 6 and 7).

Thus there is no doubt of the gradual desiccation of southern Australia in Pleistocene times. It is not due to the growth of the Flinders Range, however (as Howchin has suggested[4]), but to the migration of the polar rain belt to the south in accord with a general warming of the whole earth since the ice ages.

Penck has suggested[5] a similar course of events in other continents, especially in Africa and North America. It is obvious that there should be some corresponding improvement on the equatorial sides of the desert, for in Pleistocene times the northern portion of Australia was much more arid throughout the year than now. This is indicated by the sequence of Figures 2c, 2d, and 2e. Perhaps this is the reason that a xerophilous vegetation is throughout so characteristic of the Australian tropics (except the extreme east coast), for the Malaysian flora has not yet been able to creep back along the coastal fringe, even where conditions are suitable for its existence.

Very little physiographic work has been done in the north. Possibly the shallow depressions of Lake Woods and Lake De Burgh (lat. 18°-19°; cf. Fig. 3) are Pleistocene playas, which in the better rainfall of today are losing their desert characters. Sturt Creek runs into a "salt sea" (in latitude 20°) which is drinkable when it is full.[6] Here also the "sand ridges do not seem to be shifting perceptibly."[7]

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[4] *Op. cit.*, p. 125.

[5] Albrecht Penck: The Shifting of the Climatic Belts, *Scottish Geogr. Mag.*, Vol. 30, 1914, pp. 281-293.

IN PLIOCENE TIMES

If we carry our survey farther back into the vistas of the past—as far as Pliocene times—we reach a period when all the evidence indicates a much warmer climate than obtains at present. Thus the Carolina flora flourished in France—which means that the temperature was about 5° warmer. Now 1° F. per degree of latitude is the normal horizontal temperature gradient. Hence the isotherms were displaced approximately about 5° of latitude (or 300 miles) toward the poles in Pliocene times.

I have indicated this in Figure 2a. We see that conditions in the south of Australia were probably much more arid than at present (Fig. 2c) in Pliocene summers. Possibly Australia south of the tropic received practically no rain all the year round, except along the eastern coast. We have not enough data to pursue this aspect further, but it is of interest to note that as far as we can tell all the present indications point to a temporary return to Pliocene conditions and to greater aridity in the south of Australia. Possibly the climatic belts will move south until the condition of Figure 2c (present) develops into that of Figure 2a (Pliocene).

CONCLUSIONS

In conclusion we see that an increase in the temperature of the middle latitudes—which chiefly interest the white man—causes a poleward movement of the equatorial low-pressure rain belt. This pushes the arid belt and the polar rain belts away from the equator, with tremendous results as regards the well-being of life in the belts affected.

This has been exemplified in Pliocene times, and we seem to be living in an era when the same trend obtains. This will benefit Canada and similar lands but will thwart development in Mediterranean lands and in southern Australia.

Conversely, if the general temperature decreases in our latitudes, the rain belts will move toward the equator. This occurred in Pleistocene times. Hence in the early historic age conditions were more favorable in regions like Babylon, Carthage, and Yucatan, where the climate is now too dry or too enervating. (Huntington has discussed this question[8] but does not seem to correlate their decadence with a "uni-directional" period of aridity so much as with a temporary arid "pulse.")

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[6] H. W. B. Talbot: Geological Observations in the Country Between Wiluna, Hall's Creek, and Tananu, *Western Australia Geol. Survey Bull. No. 39*, Perth, 1910, p. 57.

[7] *Ibid.*, p. 81.

[8] E. g. Ellsworth Huntington: Civilization and Climate, New Haven, 1915.

Part II

The Climatic Control of Color and of Other Characteristics of Man

Before investigating the evolution of the human races, it seems advisable to discuss the importance of color as a factor in ethnological classification.

RACE DIVISIONS BY COLOR

The early division of the human race into white, yellow, and black does not appear to be logical in view of the general distribution of the various peoples. As I shall indicate, the following order of colors fits the data better: chocolate, red-brown, brown, olive, and yellow (Table I and Pl. V).

The white races are numerically unimportant, as are also the true black races. The South Europeans are certainly not white, nor are most of the negroes black. We may add that none of the red Indians are red, while the Australian blackfellow is chocolate!

It is most probable that primitive man was very hairy, and the Batwa of Central Africa still bear the fetal lanugo. Their chocolate color developed in accord with their original environment, which has possibly been hot and moist from Pliocene times (when, as is shown later, they probably lived near Persia) down to the present (when they live in the African forests).

THE NEGRO

The negro developed in a somewhat cooler climate, where, however, it was still hot. He lost some of the pigment and became a red-brown. When he migrated, if he reached hotter lands, he tended to become more tanned (i. e. blacker). This was largely for physiological reasons, for this enabled the sweat glands to act more efficiently and so perhaps keep the body cool. In West Africa and in Papua—both lying near the equator—he tends to become sooty, but elsewhere few negroes are really black. The dark migrants who live in cold climates (e. g. the Tasmanians) have not become white, because in my opinion they have not been there long enough to lose their original color. Most of their evolution occurred in the hotter moister regions far to the north.

THE HAMITIC PEOPLES

The Hamitic peoples, as I shall show, probably developed in a cooler region again, after the Ice Age. This type was greatly benefited by a somewhat more strenuous climate in the original Asiatic home. His brain increased notably and became more compact in its cranium. His pigment decreased on the average, and he became a brown color. This color also kept much the same as he migrated with the oncoming Ice Age, for he kept to the same climatic belt if possible. If he wandered long years in cooler regions, as did the American Hurons, the color tended to become lighter, towards olive. If he lived for long years in arid regions, he would tend to become yellow. This may explain the Hottentot coloring, though the Hottentot is, of course, a hybrid.

The Olive Peoples

In the same way the olive peoples on occupying Europe found a cool moist climate, not at all similar to their original home. Here they became "bleached," as Sergi pointed out.[9] The numerous and important olive races of America have kept to a large extent their original color because their climate is as a whole very like that of their original home.

Half-Castes

The question of half-castes of course somewhat complicates the problem. But the very fact that there is such a regular progression in every direction along the continents, outward from the Asiatic center, as my main thesis shows, is enough to prove that the climatic "thrust" was the chief factor in producing the migration zones. They are not due merely to the interbreeding of dissimilar autochthonous races.

The tendency among savage races has usually been to prevent breeding with dissimilar races, and many primitive peoples prohibit it by elaborate systems of rules and taboos. The casual newcomer was killed; while, if numerous enough, the invading hordes pushed the weaker races before them.

Stature

The stature of peoples would seem to be largely a question of favorable environment. It is certainly true that city-dwellers are shorter than farming peoples and that ill-nourished folk are usually small. This no doubt largely explains the short stature of the Eskimos, the Bushmen, etc. It is often pointed out that the Scotch and the Patagonians are the tallest races. Most people do not realize that large areas in western Patagonia have much the same environment as Scotland. It is not certain that small stature is necessarily a primitive character. The Negritos are small, but they have usually had a hand-to-mouth existence. The Neandertal type was tall and, as I suggest later, may have preceded the Negrito in the scale of human development.

Infantile Characters

There seems to be a fruitful field for research in the study of the fetal and infantile characters of the races. I have referred to the lanugo. It is said that the black negroes are red-brown at birth (while the reverse has been stated for northern Australia); that the yellow peoples are paler at birth; that the Tibetan children have chestnut hair until they are six years old. These and many other points require investigation.

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[9] Giuseppe Sergi: Europa: l'Origine dei popoli europei e loro relazione coi popoli d'Africa, d'Asia e d'Oceania, Turin, 1908, pp. 258, 259.

No doubt the psychology of the races will afford valuable evidence. The childlike behavior of the negro has often been referred to as a primitive characteristic. The white races are versatile, gay, and inventive—all attributes of youth. The yellow peoples are grave, meditative, and melancholic—which possibly indicates their more mature position in the evolution of races.

Conclusion

For the above reasons it certainly seems wise to lay little stress on color and stature as guides to the evolution of the races. Anatomical features and hair texture and section would appear to be the least variable characters, and I have used these throughout my study of the migrations. The data are derived largely from Deniker's works,[10] especially as regards the cephalic indices.

Part III

Climatic Control of the Migrations of Man

Although the details of Tertiary geography are not well known, it seems certain that by Pliocene times the continents had much the same outline as at present. The chief differences were the greater extent of Europe in the North Sea region and in the Mediterranean region. The Red Sea was absent, and a broad gulf occupied the Ural region connecting the Arctic Ocean with the Caspian. The land surface of the East Indies and of New Zealand was much greater (see Fig. 8).

There were many more land bridges (or corridors, as I propose to call them) between the continents in past history, and this greatly modified the main lines of man's migrations.

Corridors and Migrations

The characteristics of a migration have always been much the same throughout the ages. A modern "migration," such as that of a city crowd to a football match, presents some useful analogies. First come the lowest classes and pariahs, who wander freely over the ground long before the general public arrives. They have arrived there by the usual roads and tracks but ultimately are found perched in tree tops and in the least attractive positions of the ground. Then the proletariat advances along the same roads and corridors. They are driven out of the best seats, which are reserved for the last comers.

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[10] E.g. Joseph Deniker: Les races et les peuples de la terre: Éléments d'anthropologie et d'ethnographie, Paris, 1900.

Idem: Les six races composant la population actuelle de l'Europe (Huxley Lecture for 1904), *Journ. Anthropol. Inst. of Great Britain and Ireland*, Vol. 34, 1904, pp. 181-206.

In the past history of man he has moved along the same corridors, which, as noted above, were often much broader than at present. Thus the Red Sea corridor was open for many of the migrations from Central Asia toward the southwest. Gibraltar was a very favorite corridor during the earlier migrations but broke down later on. Bering Sea is still very shallow and crossed by drowned ranges (e. g. Aleutian Isles). Probably this also was dry land.

We have evidence of the enormous extent of New Zealand in Tertiary times, for it stretched nearly up to New Guinea. The same story is true of Malaysia, where the Bali-Lombok strait seems to have separated two large lands in Tertiary times. The more southern was almost certainly joined to Australia at first. No doubt North and South America were united by a broad Antillean region.

Tertiary Conditions

All the data gathered in recent years go to show that Tertiary times were much longer than has been generally supposed. Twenty-five or thirty million years is a fairly reasonable estimate. So, also, the birth of man can justifiably be pushed back one or two million years; and this allows time for much greater changes in the continents during the human era than the early geologists had been willing to grant.

The chief differences, however, between modern times and middle Tertiary times were in the elevation and especially in the climate. The latter was much warmer, as noted earlier; for trees such as sassafras, which are characteristic of an isotherm of 65° or 80°, grew readily in France (which is now 55°). We may assume that the world isotherms as a whole were moved poleward in accord with this evidence.

The great mountains of the world to a large extent came into being toward the end of Tertiary time. Thus Central Asia, in place of being an arid plateau at an elevation of 10,000 feet, as now, was previously probably something like the Central States of the United States, with a corresponding improvement in rainfall and temperature. The Central Asiatic deserts are largely rain-shadow deserts due to the mountains and are not true trade-wind deserts, like most of the other large arid regions in warm climates.

The Anthropoids

Data are very scanty as regards the evolution of man's forerunners, the anthropoids. If we plot the occurrences of Tertiary fossils (following Matthew[11]) we shall surely obtain a clue as to the limits of the hot moist forests. The Eocene monkeys occur in the central United States and in France, which indicates that at that time these were tropical forests such as those in which the lemurs live today. In Miocene times the forest belt has shrunk apparently, for the fossil anthropoids are found a little nearer the equator, in Italy, around the Aegean Sea, and in Persia (see Fig. 8).

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[11] Matthew, *op. cit.*, Fig. 7 on p. 214.

When we reach Pliocene times the fossil anthropoids are still farther south and are found in northern India and in China. This may very well indicate the limit of the forested region of Pliocene times, though it is possible it was not as hot and moist there as in the regions where the apes are found today.

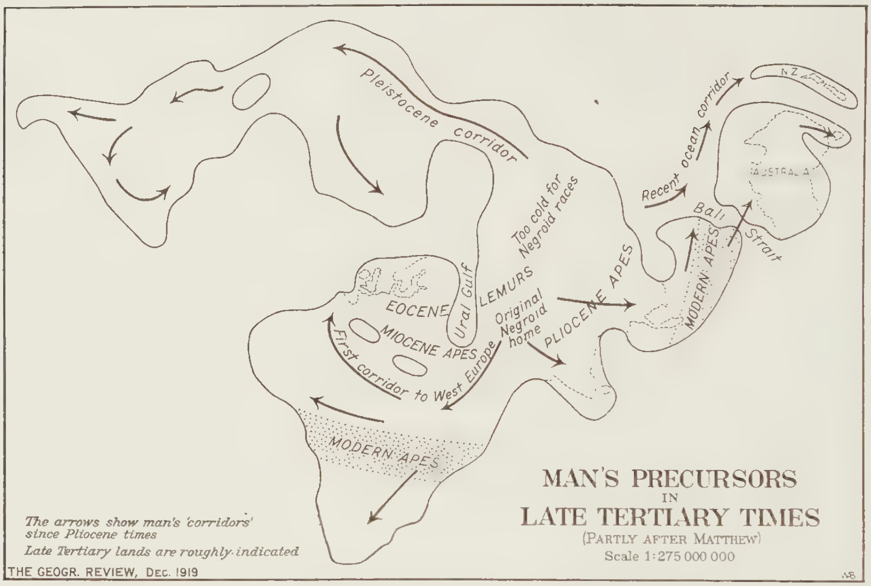
Pleistocene corridor
Recent ocean corridor
N.Z.
AUSTRALIA
Too cold for Negroid races
Bali Strait
MODERN APES
PLIOCENE APES
Original Negroid home
LEMURS
Ural Gulf
EOCENE
MIOCENE APES
First corridor to West Europe
MODERN APES
MAN'S PRECURSORS IN LATE TERTIARY TIMES
(Partly after Matthew)
Scale 1:275 000 000
The arrows show man's 'corridors' since Pliocene times
Late Tertiary lands are roughly indicated
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Fig. 8—Generalized map showing the distribution and migration routes of man's precursors in late Tertiary times (based partly on Fig. 7 in W. D. Matthew's "Climate and Evolution"). Scale, 1:275,000,000.

However, we are justified in assuming that the region between the Indian Ocean and the Aral Sea (Persia and Turkestan) was forested country with a warm moist climate. We know that the great plateau of Tibet and the Himalaya Mountains were not fully developed till the end of the Pliocene, and probably Asia as a whole was not much above sea level.

Seat of Man's Origin

From the earlier discussion on Australian climates we may assume that a warming of the earth in these latitudes to 10° F. above its present state would suffice to shift the equatorial rain belt up to the Tropic of Cancer. A broad belt of well-watered forested country would extend north of this, and it is here that it seems likely that man originated. He would develop in the more open park-land country, where his loss of tail would be no handicap and where his powers of locomotion on the surface would be exercised. Furthermore the more bracing climate on the polar side of the forest zone would make for energy and invention.

So far as we can reconstruct the isotherms these suggestions are permissible. The sea-level temperature of central Persia is about 75° now. If we imagine a rise of 10°, it becomes 85°. If we turn to Figure 2b we see that 85° agrees very well with the polar limit of the tropical rain belt.

With the equatorial rain belt so far to the north, the other belts would move north. The arid belt and polar rain belt would not, however, move so far away from present conditions as the tropical rain belt but would be "squeezed" against the central polar cold. (This is what occurs to some extent at present, for the tropical rain belt migrates much farther than, say, the isotherm of 32° F.)

It must not be supposed, however, that the equator was much hotter in the Pliocene. Probably it was even cooler than in the ice age periods. A redistribution of heat took place, as I shall show later, whereby the climates of the world as a whole alternated from uniform to zonal types.

We may therefore assume that the apes and pithecanthropoids followed the thick forests as they gradually retreated towards the equator. In Pliocene times we may picture the first man as a dweller on the edge of the forests—as are most of the primitive peoples of the world when left to their own devices (see Fig. 8).

Man's Primitive Character

Primitive man was no doubt more or less hairy all over his body and was probably below the present average stature and of a red-brown to black color. His skull was markedly dolichocephalic, and he had pronounced prognathism and black frizzy hair. (Throughout the following discussion consult Table I, p. 306, and Plate V.)

These features are all represented in the Batwa pygmies of Central Africa, who have been described from the region to the northwest of Victoria Nyanza. It is important to notice that here the climate is hot and moist, something like what we postulated for Central Asia in mid-Pliocene times.

Of the primitive characters specified above, the hairy covering is the first to disappear and is not present in allied tribes. The red-brown color is not very constant but depends on the climate. It tends to change to black in one direction and to yellow-brown in the other. The frizzy hair is very persistent, as are the other features. Stature probably varies greatly with environment and food available. In the case of hybrids the primitive hair seems to persist longer than the color, as we see in the Philippine Aeta and the Malay Sakai.

Relics of Primitive Man

With the onset of cooler conditions after the Pliocene, the ancestral home of man probably changed in character as much as any other portion of the globe. For many thousand years early man wandered in small parties through southern Asia. He would be cut off from Europe by the Ural Sea and would have no reason to move into the more inclement regions to the north. Hence we should expect to find relics of this primitive type chiefly in Africa, in India, and in Australasia.

Here, indeed, is where they occur in the form of the Negritos of Central Africa, in the pygmies of the Andamans and Philippines, in the East Indies and in Papua, and formerly in Tasmania. (Since the Negritos have cephalic indices which range as widely as the Negroes, it is possible that the primitive Negro was co-eval with the Negrito rather than his descendant. But the Negrito in his other characteristics is much the more primitive.)

The Chellean Migration

Before considering the reason for this diversity of habitats, we must discuss the conditions in the Aralo-Persian region just before the First (Günz) Ice Age (cf. Fig. 9). Here a climate better suited for a virile race had supervened. It was still warm, but not so wet as in the earlier Pliocene time. A race of taller dark dolichocephalic people developed. Their hair was still frizzy and was still flat in cross section.

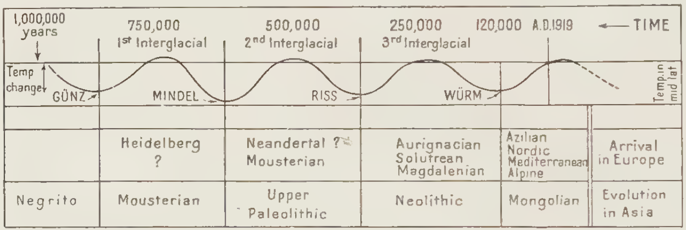

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Fig. 9—Generalized diagram correlating the minor climatic cycles and ice ages with the human migrations from Asia to Europe.

During the early Pleistocene age—when the first of the great ice ages was commencing—they migrated from their homelands. Their routes were much the same corridors as those used by the Negrito. They drove the latter before them into the less pleasing portions of the world. This series of migrations included the earlier types of Negroes, of whom we find the chief representatives today in Papua and Melanesia and in southern and western Africa.

Some tribes of this migration seem to have reached Europe, probably by way of Morocco and Spain, and have left relics in the form of the early Chellean and Acheulian implements. The earliest skulls of Neandertal (and possibly of Piltdown) may well belong to this people. They have an oval head—much longer from forehead to occiput than from ear to ear—and hence are pronouncedly dolichocephalic.

When the early glacial ages were succeeded by a warm interglacial period, these tall "longheads" penetrated into France and Britain, where they were contemporaneous with the mammoth.

We must, however, not imagine that all the Chellean people left southern Asia. There were fair lands far removed from the icy mountains of the center. Probably the regions of Persia and Turkestan were much more attractive at that period than they are now. The majority of the Chelleans would remain as near to their old home as possible, learning to overcome their environment, through the long period of the ensuing ice age.

We know that about this time the mammoth crossed the Bering region and entered North America. No doubt it was followed by a few of the outlying Chellean tribes, who slowly spread through the New World into the southern continent, though probably only in small numbers and at a much later date.

The Mousterian Migration

The next migration, thrust out by the Second Ice Age, was the "Mousterian." The Mousterians were also tall "longheads." They were much more expert workers in stone and had developed some primitive industries. They built shelter huts and were not unlike their direct descendants, the Australian aborigines.

It is difficult to decide whether the Australians were earlier or later than the true Negroes. The Veddah evidence would make them later than the Negro. Probably the Negro by stress of competition has developed his relatively high culture, while the isolated Australian has not altered from his original (late) Mousterian culture. In Perak the black Sakai are Negrito-Mongol hybrids. I find no record of true Negroes of the same "horizon" as the Bantu people in the migration toward Australia.

The hair is much less frizzled. It has become wavy or nearly straight and is oval in cross section. The face is still prognathous, the brow ridges are prominent, and the root of the nose is much depressed.

This Paleolithic race is well represented by weapons and skulls from Europe and North Africa, where it was the dominant race before the Hamitic-Iberian migration.

As with all the other primitive races it has been pushed back by the latest peoples. We find that the Mousterian Australian had displaced the Tasmanian. In southern India the late Mousterians are represented by the Veddahs and by some of the Dravidian tribes of the south. They have probably driven south the forerunners of the Nicobar and Andaman pygmies. Their characters and associates appear in the table.

In South America there is little doubt that, in the eastern Brazilian highlands, the Botocudo people are Mousterian. They have the same head index (73) as the Veddah and Australian and the same brow ridge and nasal depression. They build the same "wurley," or shelter, and wear no clothing. The ancient skulls, dug up at Lagoa Santa nearby, are even

TABLE I—MIGRATIONS OF THE HUMAN RACES, PLIOCENE TO RECENT

(Figures in table are cephalic indices)

RACE AND COLOR	AVERAGE CEPHALIC INDEX	AVERAGE ORBITAL INDEX	HAIR	HAIR SECTION	CULTURE	EUROPE	SOUTH AFRICA	NORTH AFRICA	AUSTRALIA	POLYNESIA	MALAYA	Caspian-Persian Region ORIGINAL HOME	INDIA	CHINA	EAST SIBERIA	NORTH AMERICA	SOUTH AMERICA
NEGRITO Chocolate to black	70 to 72	80 to 84	Frizzy	Flat	Acheulean ?	Too cold?	Hairy Batwa	(Dwarfs of Monuments and Somaliland)	Tasmanian hybrid 74	Fly River Papuan		Originated in Pliocene forests, possibly from Pithecanthropus type.	Mincopi, hybrid with Mongol ?	Aeta, hybrid with Mongol	Too cold	Too cold	
NEGRO Red-brown (Black in hot lands)	71 to 73	82 to 85	Frizzy to wavy	Flat to oval	Mousterian	Neandertal type arrived in early (2nd?) interglacial period	Early Bantu 71 Later 73	Early Wolof 69 Guinea Blacks	Australian aboriginal	Fijian hybrid 69 Melanesian 73	Mysore 70	Originated here in First Interglacial Period	Some Kol tribes Veddah		Eskimo hybrids ?	Calaveras skull ? Mousterian tools Greenland Eskimo hybrid 72	Bleached Botocudo and Caraya of Brazil (like Australian)
HAMITIC-IBERIAN Brown	73 to 76	84	Wavy	Flat to oval	Magdalenian Solutrean Aurignacian	Aurignacian and Solutrean of Central Europe arrived in 3rd Interglacial Some Portuguese	Aurignacian Bushmen (hybrid) and Hottentot Zulu	Fulah (hybrid) Moors	No later migrants	Moriori ?	Ceram 74	Originated here in Second Interglacial Period	Toda 74 Some Hindu	Some Lolo and Miao-tse	Bleached Ainu ?	Solutrean of California Eskimo Hurons	Solutrean in Argentina Some Brazilian tribes; Caingua etc
EARLY ARYAN Olive-brown	76 to 78	86	Wavy	Oval	Azilian Late Neolithic	Arrived after Würm Age Azilian Bleached Nordics	Hova ?	Berbers Semite Arab		Moriori 76 Samoan Maori	Most Dyaks Sikai of Flores	Originated here in Third Interglacial Period	Bengal, Afghan	Moi in south	Ainu 75	Some Algonkians and early Californian	Some Carib tribes Yahgan
LATE ARYAN (SLAV etc) Olive white	78 to 82	87	Wavy to straight	Oval to round	Bronze European	Mediterranean races and some Central Europeans	No later migrants	No later migrants		No later migrants	Javan Sumbawan	Originated after 4th Ice Age Persians 78	Some northern tribes	Japanese Korean North Chinese	Ostiaks	Zuñi Pawnee etc.	Yuracaré? Arawak Early Quechua
EARLY MONGOLIAN (TUNGUS) Pale yellow	82 to 86	90	Straight	Round	Sumerian *	Alpine races Magyar					Cambodian	Armenian Sumerian *		(Aeta hybrids	Tungus	Navajo Moki Yucatec	Some Quechua Araucanian
LATE MONGOLIAN (KIRGHIZ) Yellow	86 to 89		Straight	Round		Lapp					Burmese etc.	Kirghiz			Giliak	No later migrants	

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* Sumerian culture—perhaps the first town life—was possibly early Mongolian. Thence it soon spread to Semitic people who had a happier environment and so progressed further.

more primitive and represent earlier types of South American Mousterians. They are of lighter color for reasons suggested earlier.

In the later ice ages the climate of the center of migration in Asia was still cooler and moister. Under the influence of these controls the color of the remaining tribes became paler, changing from a red-brown or chocolate to a yellow-brown or tan color. The healthful energy-promoting climate led to a growth of civilization and intellect, which reacted on the cranium. The latter became much less oval (index 76) and more compact. The jaws decreased in size and projected less. The hair also lost its flat section and consequently did not wrinkle but was often wavy or nearly straight.

The Aurignacians

There seems to be a definite break here, between the Lower Paleolithic (Chellean, Mousterian) and Upper Paleolithic peoples, of whom the chief are the Aurignacian, Solutrean, and Magdalenian.

It seems logical to assume that the great change in culture is the outcome of a break in the continuity of descent. In fact we can with great reason place the Second Ice Age between the evolution of these peoples in Asia.

No doubt the early Paleolithic people marched south fleeing before the oncoming cold belts. Some hardier tribes withstood the environment better and reaped their reward in a more virile and intellectual posterity. These reoccupied the Central Asiatic region, on the retreat of the Mindel environment. Some hundreds of thousands of years later the oncoming adverse climate again drove most of these tribes to the south. They followed the old corridor into Africa and so arrived in western Europe in the Third Interglacial Period.

The chief characteristic of the earliest peoples in this migration was their artistic ability. The folk were oval-heads, dark brown or yellow-brown in color, and rather short. They were usually noted for their large buttocks, which are represented in many small models made by these Aurignacian peoples. The Bushmen of South Africa are hybrids who have preserved some of their characters, as Sollas has shown.[12]

Their drawings of reindeer and mammoth are found in the caves of southwestern Europe and could hardly be surpassed by modern draftsmen.

The Solutreans

They also were pushed away to the periphery of the lands in certain areas by a stronger later migration of a people known as Solutreans. Their representatives are found perhaps among the early Eskimos and allied tribes of the Arctic regions.

The characteristic laurel-leaf flints of Solutrean age are found in Argentina, California, and Mexico—where we should expect them, as a glance at the map (Pl. V) shows.

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[12] W. J. Sollas: Ancient Hunters and Their Modern Representatives, London, 1911, pp. 252-270.

Many of the later tribes of these peoples wandered into America via the Bering corridor. The Amerinds who now dwell in the northeast have cephalic indices about 76. Such tribes are the early Hurons and some of the Eskimos of Alaska. The short stature of the latter is probably a result of under-nourishment, as in so many other examples.

THE MAGDALENIANS

Professor Sollas compares the culture of the Eskimos with the prehistoric Magdalenian culture of France and Britain and shows the identity of many characteristics.[13]

The later peoples of this migration—or perhaps the earliest of the next—were the dark-brown races who are chiefly found in northwestern Africa and the western Mediterranean. They include the Iberians and other peoples who still occupy parts of Spain and Morocco. They seem to have entered Europe via the Gibraltar corridor. But later migrations crossed more directly from Asia to Europe; which may indicate when the Ural "gulf" became a feasible and broad land route. This is shown by the fact that the post-Iberian migrations have not driven the Iberians forward, but rather backward on their old track. This is, indeed, indicated in the map of the migration zones (Pl. V).

In India the dark-brown race with a cephalic index near 76 is represented by many tribes of the Deccan. In the mountain regions of southern China are the Lolo peoples, the Miao-tse, the Chiams, etc., who are of the same migration "horizon" as the Iberians and have certainly very little Mongolian blood in their veins. We know that they withstood the Chinese hordes for many centuries but were finally driven to the less attractive portions of China. Some of these tribes may, however, be a little higher in the ethnological record.

As the cycles advance we find the same general trend in evolution. The head becomes more compact, e. g. spherical, as the brain increases in size. Hence the cephalic index usually increases with the growth of culture. The hair becomes less frizzy and rounder in section. The eyes lie in rounder sockets (see orbital index in Table I). The color changes in a definite order, if we keep in mind the chief abiding place of the race in question.

THE ARYAN MIGRATION

After the Second Glacial Age the early Neolithic peoples developed in the Aralo-Persian region and were driven south by the Riss glaciation. To this migration I have applied the somewhat ambiguous term "Aryan."

In Europe the migration seems to have included the earliest "Mediterranean" peoples, whose cephalic index was below 78.

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[13] Sollas, *op. cit.*, pp. 348-350 and 368-383.

These people moved away under stress of hunger or occasional droughts and constituted the great Neolithic migration. They used polished stone weapons and erected large monoliths, which are scattered all over the world wherever their tribes migrated. These monuments occur very largely in Turkestan and southern Siberia, where the climate does not appear now to be suitable for a large population. They occur all through the north of Africa and through Persia. They are very common in northern India, Korea, Japan, and the East Indies. They are well-known features in North America and along the western coast as far as Chile. They are found even in the remote isles of Polynesia.

These Neolithic tribes followed the footsteps of more primitive peoples. They crossed into America by the same route, probably in the warm period of the Azilian age. It certainly seems more logical to assume an origin for the American Neolithic monuments similar to that of the Old World monuments and executed by allied people moving along the long-established migration route rather than to deny all connection because the links are not at present all complete. I shall return to this point later.

No doubt many of these Neolithic folk settled in large numbers along the eastern coast of Asia. They had a place in the ancestry of the Polynesians and in the Ainu, though the former have undoubtedly some later Mongolian blood also.

The Earliest "White" Races

As regards the central breeding place of the races, we have now reached the period just before the dawn of history. There is no doubt that the climate had become progressively drier in this region though not necessarily less healthy. Primitive irrigation would become a necessity of the settlers, who had taken to agricultural pursuits. This would stimulate invention and the growth of walled villages—just as was the case among the Pueblo Indians of America.

Under the stress of climatic impulse further migrants would wander away and settle in the nearest suitable regions. These wanderers of a pastoral type largely constitute the first so-called white races. Almost certainly they were more of an olive-brown, such as we see in the great majority of the Indo-Aryan races today.

They are found in northern India, in Arabia, and as scattered settlers throughout Burma and western China. Many of the Lolo peoples—the Moi tribes—and many others are fragments of migration of bearded white folk, which have been swamped by later yellow peoples.

In the south of South America it seems probable that the Yahgans are of somewhat similar origin though here the vast flood of later yellow folk has almost obliterated the earlier "white" migrants. However, some of the Tupi races in western Brazil have wavy and even frizzy hair, while the Yuracaré people of the Andes are "of very high stature, their skin being.

it is said, almost as white as that of a European."[14] More data are required to establish this zone, however, in South America.

Nordic, Mediterranean, and Alpine Races

The Fourth Ice Age intervened between the birth of the Azilian, and perhaps of the Stone Monument, peoples and that of the group of people who are now the leaders in world civilization. These are the Nordic, Mediterranean, and Alpine races of Europe and the races akin to them on the same ethnographic horizon.

They all arrived in Europe long after the last (Würm) Ice Age—following far behind the Azilians on the return of the latter to the warming northern lands. They were of an olive color, much like the Greek and Spaniard, the Japanese and Northern Chinese, the Pawnee and Cheyenne Indians of today. All these, indeed, may be cousins and not so far removed from the Britisher as are the primitive Corsican and the Moor.

They followed the immemorial corridors and spread out all over the world, driving the Stone Monument peoples before them. Possibly the transition tribes were the Ainu and Nordics, who have many points in common with the Stone Monument people. All are characterized by long hair; and indeed the ancient Druids of Stonehenge and Brittany may serve as samples of this stage of human evolution.

Deniker states[15] that the extra (third) trochanter, or process on the thigh bone, and the adjacent fossa are characteristic of these people—i. e. the late polished-stone Belgians, the Ainu, and especially the Fuegians. (He does not, however, suggest their kinship on a common ethnological horizon, which seems to me obvious in view of their position.)

Relation of White and Yellow Races

The Ainu people are sufficient in themselves to disprove the fallacy that the white man is a cross between the yellow and black races. Where are the black races which are supposed to have mixed with the yellow to produce the Ainu, who, indeed, are not far from a typical Nordic people?

If the white man is developed from the yellow man, then logically the whole distribution of the races (as shown in the migration map, Pl. V) must equally indicate that the negro is developed from the white man!

As regards the status of the white and yellow races, it seems obvious that the Japanese and Northern Chinese are distant cousins of the chief peoples of Europe, i. e. those living between the Mediterranean and Nordic peoples. These pale-olive peoples of the East have of course some later Mongolian blood in them, as their lack of beard suggests. They are apparently free from the dark Iberian blood with which the Europeans of the same horizon are usually endowed. Hence biologically the Japanese cannot be said to be inferior to the European.

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[14] Joseph Deniker: Les races et les peuples de la terre: Éléments d'anthropologie et d'ethnographie, Paris, 1900, p. 631. Cf. also L. E. Miller: The Yuracaré Indians of Eastern Bolivia, *Geogr. Rev.*, Vol. 4, 1917, pp. 450-464, especially pp. 450-451.

[15] *Ibid.*, pp. 103-105.

Deniker says[16] of the Japanese: "The fine [i. e. higher] type . . . . . is characterized by a tall slim figure, a relative dolichocephaly, elongated face, straight eyes (in the men), ... thin, convex, or straight nose . . . . . . The color varies from pale yellow, almost white, to brownish yellow."

We must remember that the evolution of these races has extended through several hundred thousand years. The superiority or inferiority of a race as a whole cannot be determined by what has occurred in the last few hundred years. The idea of the superiority of the white race is natural in view of its present position. But we should remember that the belief was certainly not prevalent in the early Middle Ages, when Mongolian and even American civilization was practically on a level with ours.

Is it not possible that the Sumerian culture in Persia—perhaps the first true civilization—was due to early Mongolians? Petrie speaks[17] of the Sumerians as "shaven people," but the portraits have some appearance of the early Mongolian type.

Culture is largely a result of favorable environment; and by this time the early olive-white races had occupied the best regions and so ultimately developed the highest type of civilization. But they may have been taught by the Sumerian Mongol.

POLYNESIANS AND AMERICANS

The Japanese peoples are said to have driven back the Ainu only so late as 600 B. C. No doubt the great Polynesian migrations date from somewhere about the same time. The Polynesians were pushed forth from the southeast of Asia long after navigation was understood. Many of the tribes in the Malay and Burmese regions are closely akin to the Polynesians, as are many of the Indonesian. Proximity to China has resulted in numerous migrations of brachycephalic Mongolians who have nearly swamped the olive peoples in many of the islands of Malaysia.

All round the American Andes we find peoples closely akin to these olive races of the Old World. Data are not readily obtained as to their ethnological coefficients, but we know that they have the olive color, the aquiline nose, and a similar high degree of intelligence. It is not difficult to connect the Indians of North and South America, for Deniker states[18] that the "Inca bone" of the cranium is found chiefly among the ancient Peruvians and the prehistoric dwellers of the Salt River Valley, Arizona, showing their close affinity. It occurs also in some Europeans, and, though I have not seen the data, I expect that those with the same cephalic index (near 80) will be found to be the possessors of this link with the ancient Incas. An analogous distribution probably occurs with regard to the *Os japonicum* of the cheek, i. e. in the Japanese and their equivalents in Europe.

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[16] *Op. cit.*, pp. 450 and 451.

[17] W. M. Flinders Petrie: Eastern Exploration, Past and Future (Lecture at the Royal Institution), London, 1918, p. 67.

[18] Deniker, *op. cit.*, p. 79 (the latter reference based on Washington Gladden: Human Bones of the Hemenway Collection in the United States Army Medical Museum, *Memoirs Natl. Acad. of Sci.*, Vol. 6, pp. 139-286, Washington, D. C., 1893; reference on pp. 187-190).

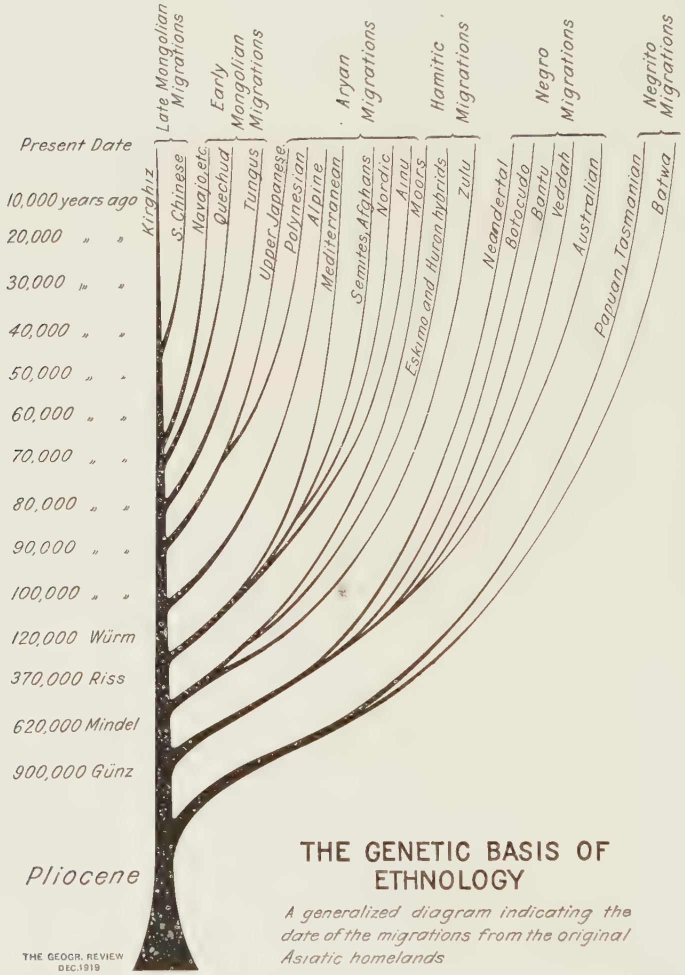
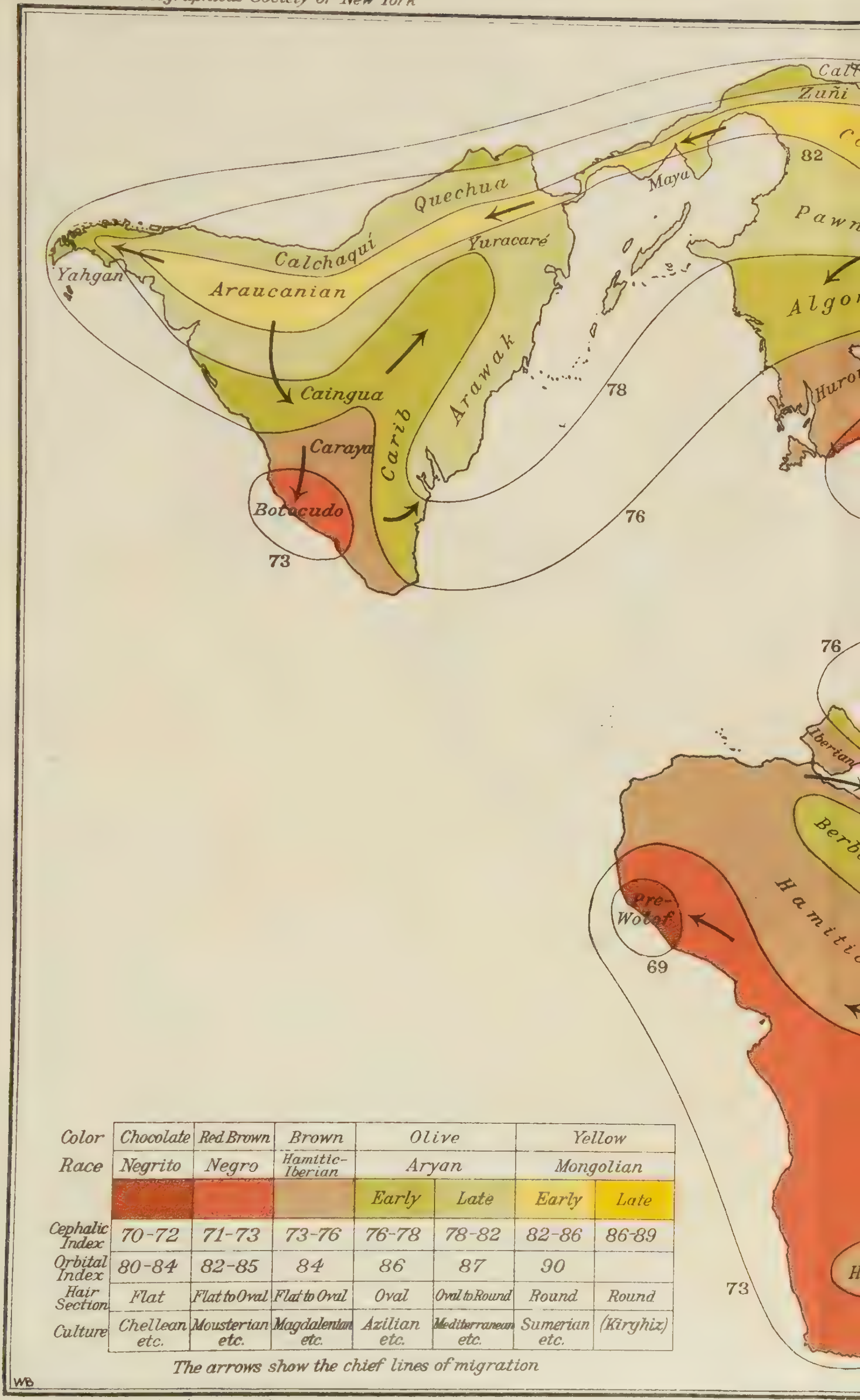


Fig. 10—Generalized diagram indicating the period in the geological time scale of man's migrations from the original Asiatic homelands.

Later Migrations from Asia

We have now finished with the Pleistocene ice ages—for we are now living in the Fourth Interglacial Period.

The American Geographical Society of New York



Color	Chocolate	Red Brown	Brown	Olive		Yellow	
Race	Negrito	Negro	Hamitic-Iberian	Aryan		Mongolian	
	🟫	🟥	🟫	Early	Late	Early	Late
Cephalic Index	70-72	71-73	73-76	76-78	78-82	82-86	86-89
Orbital Index	80-84	82-85	84	86	87	90	
Hair Section	Flat	Flat to Oval	Flat to Oval	Oval	Oval to Round	Round	Round
Culture	Chellean etc.	Mousterian etc.	Magdalenian etc.	Azilian etc.	Mediterranean etc.	Sumerian etc.	(Kirghiz)

The arrows show the chief lines of migration

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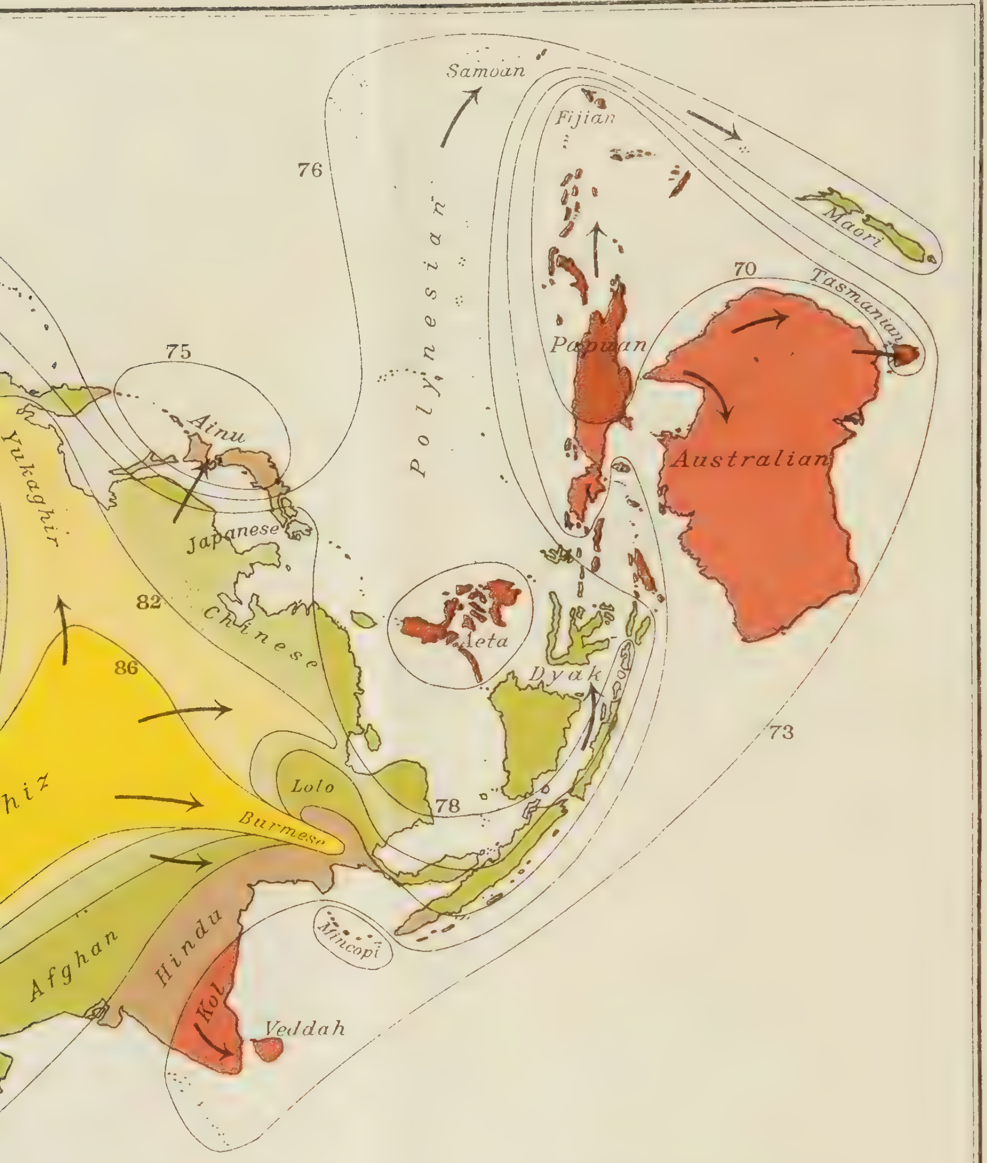

ZONES OF MIGRATION
SHOWING THE
EVOLUTION OF THE RACES

Based mainly on the cephalic indices of
the most primitive tribes in each region

BY GRIFFITH TAYLOR

Scale 1:100 000 000

Polar zenithal equidistant projection

JULIUS BIEN LITH N.Y.

But the climatic control does not therefore cease to cause migrations. It is, however, *drought* which has caused the later people of Asia to swarm forth from time to time. Huntington has investigated this question very carefully,[19] so that the "pulse of Asia" is now beyond doubt. This pulse was much weaker than the "thrusts" of the ice ages but operated in the same fashion.

Some great period of inclement climate in Central Asia drove out many of the early Asiatic peoples, and they appeared in Europe as the Alpine races and later as the Slavs. These arrived about the dawn of the historical period.

The Huns were true Mongolians, and the Magyars also have a cephalic index about 85 (see Table I). They spread through Europe (via the Urals) between 400 and 500 A. D. In the next century occurred the Avar migration, and in the sixth century that of the Bulgars. Many Slav people came in about 750 A. D., while Mongol Finns reached Flanders in 955.[20]

The African Semitic races made one or two migrations (probably as the result of "thrusts" on their eastern marches). Thus the Arabs reached Gibraltar in 710 and France in 730. A mixed race with some Semitic blood composed the Turkish invasion which approached Constantinople about 1000 A. D.

EARLY MONGOLIAN MIGRATIONS TO AMERICA

The last migrants to America were some of the earlier Mongols. Deniker states[21] that the Yukaghirs of Verkhoyansk approach very closely to certain northern Amerinds. They moved along the Rocky Mountains and the Andes as before. Down in the far south are the Tehuelches (index 85) with oblique eyes. Some of the Peruvian Quechua tribes are similar. So also are the people of Yucatan and many tribes allied to the Navajos. In all these cases crossing has hidden some of the characters, but the cephalic index always increases as we approach the great corridor of migration.

The British Columbian Indians may very likely be akin to an earlier migration, for their culture (e. g. carvings and canoes) has many affinities with the Maoris. I have no data of their coefficients.[22]

In Asia the Mongols burst through into India and founded the Mogul Empire in the seventeenth century. At a much earlier date, about 3000 B. C., the Mongols drove to the northeast the earlier people of China. This latest type of Mongolian "roundhead"—of whom the Kirghiz are a type—has never apparently reached America. Nor has their environment led them to develop any notable culture.

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[19] Ellsworth Huntington: The Pulse of Asia. Boston, 1907.

[20] W. M. Flinders Petrie: Migrations (The Huxley Lecture for 1906), *Journ. Anthropol. Inst. of Great Britain and Ireland*, Vol. 36, 1906, pp. 189-232; reference on p. 215.

[21] Deniker, *op. cit.*, pp. 431-432.

[22] On the map of North and South America showing cephalic index on p. 302 of Clark Wissler's "The American Indian," New York, 1917, the figures for the British Columbia area are 81 (Puget Sound), 80 (interior plateau: Thompson Indians?), and 83 (Alaska Panhandle: Tlingits).—EDIT. NOTE.

ASIATIC INVASIONS AT THE PRESENT TIME

Even at the present time the same Asiatic invasions occur. The Slav races are driving the Germans to the west, and partly in consequence the Germans were very largely settling in London before the war. The British again are emigrating before the economic pressure of the later races in central Europe.

It may be that the olive-white peoples with a cephalic index from 78 to 83 mark the zenith of the human race, but modern civilization has so short a history and is so obviously the product of a favorable environment that we have no right to assume so.

In Figure 10 I show how this charting of the migration zones affects the genetic ''tree'' of the human race. If it be accepted, then the accepted schemes of ethnographic classification will obviously need considerable modification.

Part IV

Climatic Cycles in the Geological Record

TEMPERATURE CHANGES IN THE GEOLOGICAL PAST

It is clear from the earlier discussions that the north temperate zone (or mid-latitudes, as they are preferably described) was on the whole cooling during early Tertiary times.

With the Pleistocene we get the extraordinary oscillations in climate shown by the four ice ages and the three interglacial ages. If we take the present mean temperature of central Europe at about 50° F., then we may estimate the corresponding temperatures during earlier epochs as given in the following table. (The temperatures at latitude 30° N. and at the equator have been added for comparison.) These temperatures are based on paleobotanical and other evidence, but are, of course, only the roughest approximations.

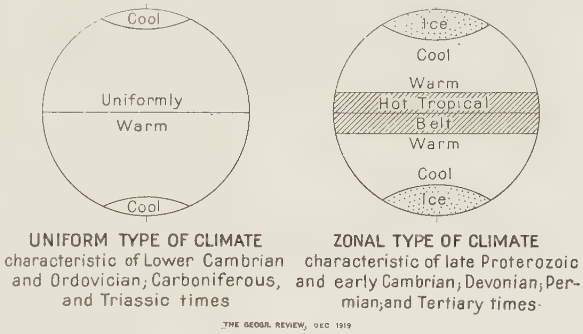
TABLE II—ESTIMATED CHANGES IN TEMPERATURE, PRESENT TO TRIASSIC

(In degrees Fahrenheit)

AGE	CENTRAL EUROPE; LAT. 50° N.		REGION OF ANCIENT CIVILIZATIONS: ABOUT LAT. 30° N.	EQUATOR (SUGGESTED)
Present	50	(10° C.)	76	80
Historic	47		72	79
Neolithic	43		68	79
Würm Ice Age	40		65	82
Third Interglacial	52		76	80
Riss Ice Age	37		62	83
Second Interglacial	50		75	79
Mindel Ice Age	35	(Maximum zonal climatic type)	60	84
First Interglacial	52		76	79
Günz Ice Age	40		65	82
Pliocene	65	With some diminishing fluctuations corresponding to the Pleistocene cold periods	76	78
Miocene	70		76	77
Eocene	75		77	77
Cretaceous	76		77	77
Jurassic	76		77	77
Triassic	76	(Uniform climatic type)	77	77

The third column is in accord with the results of marine paleontology. Thus Smith writes[23] that during the Triassic there was "nearly uniform distribution of warm water over a part of the globe." Of the Jurassic Schuchert states[24] there was "a very wide medial warm-water area, embracing the present equatorial *and temperate zones,* with cooler *but not cold water* in polar areas." In the Lower Cretaceous we get some evidence of a *zonal* climate like the present, which did not last long, for the *uniform* climates held sway through Cretaceous and Eocene times (see Figs. 11 and 12).

It is in the Miocene, however, that the zonal type begins to predominate, and thence it continues to the present. In other words, in the early Tertiary we begin to see premonitions of the oncoming glacial periods in a series of fluctuations which gradually increase in intensity.



UNIFORM TYPE OF CLIMATE
characteristic of Lower Cambrian and Ordovician; Carboniferous, and Triassic times

ZONAL TYPE OF CLIMATE
characteristic of late Proterozoic and early Cambrian; Devonian; Permian; and Tertiary times

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FIG. 11—Diagram illustrating the two types of temperature distribution, uniform and zonal.

It is evident that we have here, but at a very much slower rate, a steady change of climate of the same type that we saw in Pleistocene and Recent times. Instead of alternations from cold to warm for mid-latitudes, we get a change from uniform to zonal which operates over the whole world, as is indisputably shown by the life record (see Fig. 12).

The growth rings of fossil plants corroborate this very remarkably, for they changed greatly in character during the last major cycle, as Schuchert reports.[25]

PRE-TERTIARY CLIMATIC CHANGES

I was therefore led to study the conditions of climatic changes in earlier geological periods (cf. Table III); and I found that the same sequence led up to the preceding ice age, that of the Permian.

David has shown[26] that there were three or four interglacials in the

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[23] J. P. Smith: Ancient Portals of the Earth, *Pop. Sci. Monthly,* Vol. 80, 1912, pp. 393-399; reference on p. 398.

[24] Charles Schuchert: Climates of Geologic Time, pp. 265-298 of Ellsworth Huntington's "The Climatic Factor as Illustrated in Arid America," *Carnegie Instn. Publ. No. 192,* Washington, D. C., 1914; reference on p. 281.

[25] *Ibid.,* p. 279.

[26] T. W. Edgeworth David *et al.:* The Geology of the Commonwealth, pp. 241-325 of "The Commonwealth of Australia: Federal Handbook Prepared in Connection with the Eighty-Fourth Meeting of the British Association for the Advancement of Science Held in Australia, August, 1914," Melbourne, (1914); reference on p. 274.

Permian glacial deposits of Australia. Hence the zonal climates occurred then exactly as in the Pleistocene and late Tertiary times.

In Carboniferous times we note exactly the same warming of the environment as we move further from the Permian. This is also coupled with the adoption of a uniform climate throughout most of the world. A cursory glance at Schuchert's masterly summary of past climates[27] will convince the student of the truth of this statement. He writes also:[28] "The world-wide warm-water condition of the late Devonic seas of the northern hemisphere was continued into those of the Lower Carbonic." And, again:[29] "after middle Devonic times the climate of the world was as a rule uniformly warm and more or less humid and remained so to the close of Upper Carbonic time."

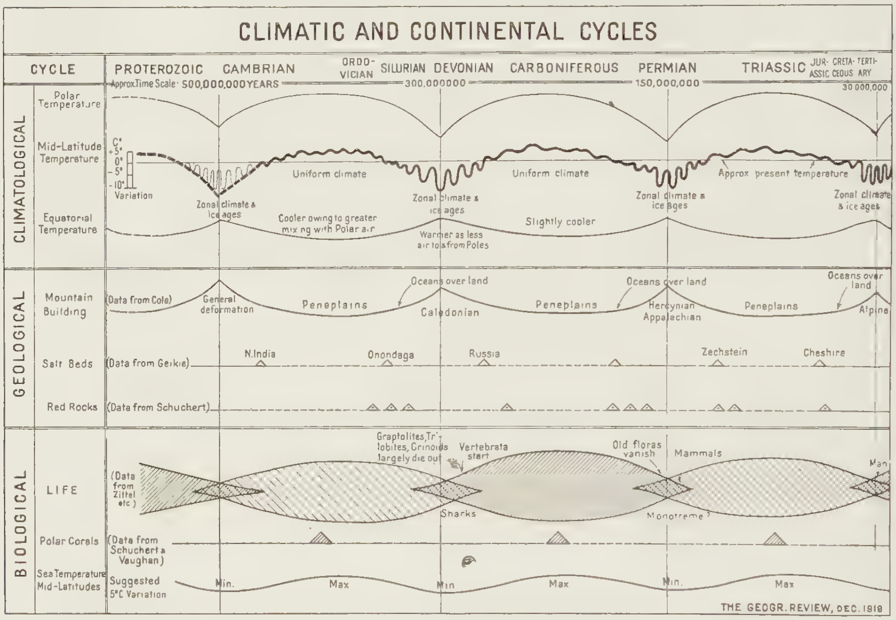

FIG. 12—Diagram showing the three major cycles in the climatological, geological, and biological records.

Let us now push our inquiry farther back again, using the same authoritative survey as our test. We get the same cycle of conditions.

"The temperatures of air and water had been mild to warm throughout the world since the beginning of Cambric time—there was a marked increase of warmth in the Upper Cambric, and these conditions were maintained through the Ordovicic and the earlier half of the Silurian."[30]

The Silurian closed with a period of zonal climates, culminating in an ice age, which has been recorded from South Africa. At Table Mountain (*fide* Schuchert[31]) are 5,000 feet of quartzites with striated pebbles up to 15 inches long.

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[27] Work cited in footnote 24.
[28] p. 277.
[29] p. 278.
[30] pp. 276-277.
[31] p. 269.

TABLE III – CYCLES IN THE GEOLOGICAL RECORD, FOR NORTH TEMPERATE LANDS CHIEFLY

(Quotations from Schuchert in "The Climatic Factor")

CYCLE		STAGE I Somewhat Zonal Climate Mountain Building Cool, but warmer than present	STAGE II Culmination Ice Ages and Interglacial Periods Mountain Building (Many genera die out) Colder than now, on whole	STAGE III Somewhat Zonal Climate at first Warm, drier	STAGE IV Uniform Climate Red Sands Salt Deposits Warmer, arid	STAGE V Culmination Uniform Climate Peneplains Warmer, moist	STAGE VI Uniform Climate Red Sands Salt Deposits Warm, arid
1st Cycle	RECENT		Interglacial age				
	PLEISTOCENE		Four ice ages Man develops				
	–PLIOCENE– MIOCENE	(Oaks in Spitsbergen)					
	EOCENE	Early cold cycle San Juan, Colo					
	CRETACEOUS	"In N. Europe no warm seas" Mountains Sierra Nevada etc uplifted					Red sands
	JURASSIC						"Cooler than Trias" Climatic zones begin
	TRIASSIC				Plants scarce (Upper) Red sands, Salt deposits New marine fauna (Lower)	Subtropical U.S. to Spitsbergen. (Nearly uniform warm water over globe)	
	UPPER PERMIAN		First land animals Appalachian folding ends.	Vanishing swamps			
	LOWER PERMIAN		Great ice age { Urals ? Australia S. Africa, India, Brazil				
2nd Cycle	UPPER CARBONIFEROUS	"Coolness and some glaciation" (Barrell) Appalachian folds start					
	MIDDLE CARBONIFEROUS					Warm in Spitsbergen Coal at Cape Lisburne, Alaska	
	LOWER CARBONIFEROUS					Warm seas and corals U.S. to Alaska	
	UPPER DEVONIAN			Increased "warmth in Upper Devonian" (Barrell) as compared with Lower Devonian	"Upper Devonian aridity" (Barrell)	Coal at Bear Island	
	LOWER DEVONIAN		(Old Red Sandstone glacial evidence in England ?) "Entire stocks blotted out." Sharks and other Vertebrata start Mountains and volcanoes in New England & Canada				
3rd Cycle	UPPER SILURIAN	"Caledonian Mountains"	"5000 feet of glacial deposits in S Africa harmonize with cold climate" (Barrell). Chiefly apparent in Southern Hemisphere				Arid Climate
	LOWER SILURIAN					Mild and uniform climate "Warmer than Upper Silurian"	
	ORDOVICIAN				Mild and uniform climate Red sands (Schuchert) Reef corals in North		
	UPPER CAMBRIAN			"Markedly warmer than Lower Cambrian"	"'Lime habit' came in dominantly," suggestive of warm seas		
	LOWER CAMBRIAN		Some mountain building in E America and W. Europe				
4th	UPPER PROTEROZOIC	Greatest ice age in the record! Australia; China, Norway etc Great mountain building					
5th	MIDDLE PROTEROZOIC	Ice age of earlier cycle probable at Kadapah horizon, India, in Pretoria series, and Torridonian ?					
6th	LOWER PROTEROZOIC	" " " " " possible at Huronian level ?					

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It seems much more than a coincidence that this glacial epoch should be placed just here in the geological record. We must remember that the whole story of Cambrian and Permian ice ages is only a very few years old and that each year sees more and more evidence coming to light in support of their world-wide occurrence. No doubt the Devonian glaciation will be traced in many more regions in the near future.

If we go still farther back we get another great ice age, that of the late Proterozoic (or earliest Cambrian). This also fits into place in the cycles as far as we can judge from our knowledge of the time intervals since the Proterozoic. In the Proterozoic itself there are two early ice ages in all probability. These are indicated in Table III. No doubt they represent two earlier major cycles.

To sum up this aspect of the problem, we find that uniform climates govern the world for long periods of geological time. Then great disturbances ensue which give zonal climates of relatively short interval (say 200,000 years) which culminate in an ice age with marked interglacials. This type slowly passes away, and the world enters into its normal uniform climate again.

The zonal climates and great ice ages occur in late Proterozoic, Devonian, Permian, and late Tertiary times. The three periods of uniform climate occur in late Cambrian and Ordovician, in Carboniferous, and in Triassic times. The change from one to the other is, of course, gradual, as indicated on the graph (Fig. 12).

Periodicity of Warm Uniform Climates

This in itself is an important step to have taken in past climatology, but if we look more closely into the evidence we shall find that our study of Australian climatology will lead us much further.

We saw there that the desert belts migrated back and forth in the interglacial periods. Do they migrate in the oncoming and waning uniform period? There seems no doubt that they do. The zonal changes are passed through quickly but are of the same type as the vastly slower changes during the start and finish of the uniform climatic period.

If we take any given latitude belt, such as from 40° to 60° N., we shall find that it has been affected by the arid belt in greater or lesser degrees in past time. Thus Geikie gives[32] five notable horizons in which salt deposits and salt springs occur. These are the Lower Cambrian deposits of the Salt Range in India, the Onondaga salt beds of Canada, in the early Silurian; the Russian salt beds of the Upper Devonian; the Zechstein of the late Permian; and the Cheshire deposits of late Triassic (see Fig. 12). If we plot these on the graph we find that they occur midway between the ice age and the center of the uniform climate period in each of the cycles. Thus the north temperate lands passed from the cold wet periods of the ice ages, through the warm dry periods of the salt deposits, to the warm moister center of the uniform period; and so back through the dry period to the next ice age.

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[32] Archibald Geikie: Text-book of Geology, London, 1882, pp. 661, 692, 704, 757, 759, 765.

If we plot the red sands, as given by Schuchert[33], these arid deposits occur in almost the same periods as the salt (see the series of symbols in Fig. 12).

Let us now look at the presence of coral reefs in polar waters. Schuchert mentions[34] three notable examples. These occur in the Middle Ordovician from Alaska to Oklahoma, in the Lower Carboniferous, and again in Triassic times. No clearer proof is surely needed of the periodicity of warm uniform climates throughout the world (Fig. 12).

Testimony of the Biological Record

We must remember that at the present time land temperatures vary from +120° F. down to —90° F., a range of 210°. Sea water at the present time has a range from about +80° down to +28° F. At this lower temperature the pack ice effectively protects the water from the cold air, and the lower waters do not freeze. As a consequence polar seas are teeming with life. The floor of the Ross Sea is almost paved with siliceous sponges and swarms with shrimps and diatoms.[35] Hence we should not expect our climatic changes to have anything like so much effect on marine organisms as on land organisms—for the range is only 52° as opposed to 210° even in zonal periods. In the uniform periods probably the seas were almost the same temperature from equator to pole.

Let us now turn to the biological record (Fig. 12, bottom). There are four outstanding periods. The first is the dawn of the Cambrian, which for long years marked the oldest record of fossil life. We now know of many fossils in somewhat older rocks, but there is no doubt that some enormous change in environment affected life then.

At the close of the Silurian we have another critical stage. There were feeble precursors of the vertebrates before the Devonian, but the vast array of sharks and true vertebrate fishes commenced in the Devonian. Some great change blotted out all the graptolites, most of the trilobites, and many families of crinoids about that time also.

At the close of the Carboniferous the land floras changed remarkably, and we may with certainty follow Matthew[36] and place the birth of the mammals in the Permian. Now the first reptiles crawled on the land, and it is surely more than a coincidence that the primitive mammal (the platypus) still maintains his amphibian method of life.

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[33] *Op. cit.*, pp. 273-274.

[34] *Op. cit.*, p. 276 (based on T. W. Vaughan), 277, 280 (based on J. P. Smith).

[35] See "With Scott: The Silver Lining" (1916), where I have discussed this question fairly fully (pp. 74-75 and 83).

[36] Matthew: Climate and Evolution, p. 181.

The close of the Tertiary marks the culminating point in life—the dawn of the human age. No doubt the monkeys flourished in late Tertiary times, but it was the strenuous times of the Pleistocene which picked out the dominant type of mammal and gave to man the proud position which he occupies.

Surely these four stages, in agreement with the four zonal periods, indicate a cyclical type of evolution. The Cambrian is the dawn of an infinite number of new forms; the Devonian marks the birth of the vertebrates; the Permian the birth of the mammals; and the Pliocene and Pleistocene the birth of man.

TESTIMONY OF THE GEOLOGICAL RECORD: PERIODICITY IN MOUNTAIN BUILDING AND VULCANICITY

There remains one more cyclic phenomenon which I have not yet discussed. It has long been noted that the ice ages agreed with the periods of great mountain building (Fig. 12, middle).

If we study Cole's interesting account of the "Growth of Europe,"[37] we find that he specifies three main stages in the building of the continent. In late Silurian and early Devonian times occurred the great Caledonian uplift, which altered the whole shape of western Europe. In Permian times was the Hercynian period, when central Europe was puckered into great east-and-west folds. (This is the American Appalachian period.) In late Tertiary times we have the "Alpine storm," as he terms it, when the central portions of Europe were tossed like sea waves. This started at the end of Mesozoic times and culminated in Pliocene times, when all the great mountains of the world were raised to their present height.

Between these maxima—which coincide absolutely with the zonal-climate periods—there were stages of passivity. Great peneplanation occurred in the Ordovician, Carboniferous, and Triassic. Towards the close of these periods the first tremors of the zonal period were felt. As a result the seas largely invaded the flat continents, and we get the great transgression periods of the Silurian, early Permian, and Cretaceous. These also fit into the cyclic changes.

It would seem to me impossible to deny this periodicity, when the careful world surveys of so many investigators—Schuchert, Geikie, Cole, Zittel, and others—all point the same way.

It is not reasonable to expect every detail in the whole geological record to agree absolutely, for it is not suggested that no other factors operate beyond those here discussed. Vulcanicity is a test case. A world-wide survey will, I am sure, show some such arrangement as the following.

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[37] Grenville A. J. Cole: The Growth of Europe (in series: The Home University Library of Modern Knowledge No. 84), London and New York, [1914].

TABLE IV—Periodicity in Mountain Building and Vulcanicity

Periods of great mountain building and major vulcanicity (zonal type)	Late Proterozoic Early Cambrian	Late Silurian Devonian Early Carboniferous	Permian Early Triassic	Late Jurassic Cretaceous Tertiary
Periods of feeble mountain building and minor vulcanicity (uniform type)	Late Cambrian Ordovician Early Silurian	Middle and most of late Carboniferous	Triassic Early Jurassic	

But it is impossible to pick out one small country, such as England or Victoria, and judge by that alone.

A similar example of error from a limited survey would ensue if one were to study the climatic cycle during late Tertiary times merely as it occurred on the Sydney coast. Here the proximity to the sea and general onshore winds have probably given it a fairly uniform rainfall through late Tertiary times. We must study a continent as a whole, and then there is no doubt of the striking seasonal swing in one year or of the marked periodicity through long ages which I have tried to demonstrate in an earlier section.

If we study Australian igneous rocks[38]—as far as one can determine their ages—we find that they occur chiefly in the Pre-Cambrian, Cambrian, and Heathcotian (Cambrian?), that they are less important in the Ordovician and Silurian, and that they are very important in the Lower Devonian. The (Australian) New England and similar rocks may possibly be late Carboniferous; some are placed as Permian. The Triassic is poorly represented. The later Mesozoic and Tertiary agree with my hypothesis.

For Britain Geikie gives the following résumé.[39] Archean and Lower Cambrian show much vulcanicity (as also does Lower Silurian, which does not agree with the curve in Fig. 12). Then Lower Devonian was a time of prolonged activity, and early Carboniferous. Permian times witnessed many vents in Scotland. There were no outbursts in Triassic times; but, with the Tertiary, action begins again.

When we remember that it is very difficult to determine the age of igneous rocks, we may well consider that the relation of vulcanicity to zonal (disturbed) periods has been fairly brought out even in such a small region as Britain.

Part V

The Time Scale

Length of the Geological Periods

It is of course much easier to detect a period in a long lapse of time than to give the absolute value of such a period or cycle in years.

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[38] Section on "Igneous Rocks" by T. W. Edgeworth David and E. W. Skeats (pp. 302-314) of work cited in footnote 26.

[39] Archibald Geikie: The Ancient Volcanoes of Great Britain, 2 vols., London, 1897, see Chapter 51.

Until recently geologists had no hope of determining the exact interval which had elapsed since the Proterozoic period. Stratigraphers have made many attempts and have divided the geological record into certain proportions. Thus the appendix to a popular article by Sollas[40] gives the tentative percentages listed in column A in the following table.

TABLE V—RELATIVE AND ABSOLUTE LENGTH OF THE GEOLOGICAL PERIODS

AGE	A (PER CENT)	B (PER CENT)	C (PER CENT)	D	E
Cambrian	16	16	33	500,000,000 years ago	300,000,000
Silurian	16	12		430,000,000 " "	
		5			
Devonian	35	5	33	370,000,000 years ago	150,000,000
Carboniferous		20			
Permian		8			
		3			
Mesozoic	25	25	34	30,000,000 (Eocene)	
Tertiary	8	6			
Total	100	100	100	500,000,000 years	300,000,000 years

A slight rearrangement—which can hardly be objected to as far as stratigraphy is concerned—would give us the ratios shown in column B. If these be subdivided in Devonian and Permian times—as the periodic graph demands (see Fig. 12)—then the agreement with the latter is absolute, and we have the geological record separated into three equal cycles by the Devonian and Permian epochs.

Holmes in 1913 in the "Age of the Earth" gives[41] the results of radioactive tests on the breaking down of various minerals. He would seem to favor 30,000,000 years (at least) for the Tertiary period and something over 430,000,000 years since the dawn of the Cambrian. Joly quotes[42] similar figures, indicating about 300,000,000 years as the time interval since the same epoch.

If we agree (as in column B) that the Tertiary occupied 6 per cent of the geological scale and that this is about 30,000,000 years, then the interval since the dawn of the Cambrian is from 300,000,000 to 500,000,000 years on all four scales in the table. This is perhaps as close an estimate as we can expect to make with the incomplete data at our disposal.

RELATIVE LENGTHS OF THE MINOR AND MAJOR CLIMATIC CYCLES

As regards the minor cycle (see Fig. 9), comprising the ice age between two interglacials, the evidence in the Pleistocene is somewhat better. In the Antarctic in 1911 we had a great deal of discussion on this very point, when I instanced the graph given by Hess in his book on glaciers.[43] I describe this incident, which occurred when we were literally experiencing an ice age, in my book "With Scott: The Silver Lining."[44]

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[40] W. J. Sollas in Harmsworth's "History of the World."

[41] Arthur Holmes: The Age of the Earth (in series: Harper's Library of Living Thought), London and New York, 1913, pp. 137-165.

[42] J. Joly: Radioactivity and Geology: An Account of Radioactive Energy on Terrestrial History, New York, 1909, pp. 227-230.

Idem: The Birth-Time of the World, and Other Scientific Essays, London, 1915, pp. 19-29.

Later data (such as the chart given by Osborn[45]) seem to show that the Mindel-Riss Interglacial was the coldest and that the post-Riss period was warmer. Hence we have passed the culminating point. If the Pleistocene be taken as occupying 1,000,000 years, as Holmes suggests, then the four ice ages occurred at intervals of about 250,000 years. It follows that we may expect another cold period in about 100,000 years, though the indications are that it will be much milder than the Würm Ice Age.

It may be objected that Osborn does not place these epochs at equal intervals. On the other hand Hess does; and I incline to the latter view for the following reason. Nature in all her grander manifestations seems to be following cyclic laws. If we can detect the indication of a cycle with which many phenomena are in harmony, we shall be amply justified (by many similar discoveries in the past) in adopting the cycle as a most useful instrument for further investigation. As an illustration, I may add that I had realized the probability of interglacials in the Permian and had discussed it with a fellow geologist, who doubted the possibility of detecting them, before I found that Professor David had already described such.[46]

Thus the minor cycles are about 1/800 the length of the major cycles. From the fluctuations which are apparent in the Jurassic and Cretaceous, when colder conditions began to alternate with warmer uniform conditions, we may assume that these short-period cycles occur to a less marked degree in the periods between the major ice ages. In other words the minor cycle seems to be superimposed on the major cycle, but its amplitude increases as the major cycle culminates. However, this is all somewhat speculative and, like the succeeding sections, is only put forward as a suggestion.

Part VI

Suggestions as to the Causes of the Major and Minor Cycles

It has long been noted that mountain-building synchronized with the great ice ages. So far as I know no one has given a reason which explains both phenomena. The ice age does not directly depend on elevation, for the cold epoch affects lowlands also and sends great sheets of ice across the oceans.

I suggest that the common cause may be reached by way of a consideration of the circulation of the atmosphere.

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[43] Hans Hess: Die Gletscher, Brunswick, 1904, p. 383.

[44] pp. 280-281.

[45] H. F. Osborn: Men of the Old Stone Age: Their Environment, Life, and Art, New York, 1916, p. 23.

[46] T. W. Edgeworth David: Evidences of Glacial Action in Australia in Permo-Carboniferous Times, *Quart. Journ. Geol. Soc.*, Vol. 52, 1896, pp. 289-301.

Retardation of Earth's Rotation as Possible Cause, Producing Change in Atmospheric Circulation Resulting in Ice Ages

It will be admitted that high latitudes receive their meager supply of warmth chiefly by means of the poleward air currents. A striking example is seen in the North Atlantic, where the steady warm southwesterly winds and associated drift keep the sea open to Spitsbergen almost all the year round.

If this atmospheric circulation were increased we should get a much greater mixing of polar and equatorial air, and the whole earth would become of a much more uniform temperature. The ice caps would probably vanish; but in compensation the equator would probably be somewhat cooler than at present. This is exactly the condition which has obtained through the greater part of the geological record, as I have shown in an earlier section.

Now, what could cause the circulation of the atmosphere to change in character in this fashion? The simplest answer is to imagine a slight variation in the diurnal rotation of the earth. At present a spot on the equator moves round to the east at the rate of 1,037 miles an hour. As a result the pressure belts lie (in the southern hemisphere) about 35° S. (high pressure) and 65° S. (low pressure). If, however, the dynamic factor, which largely determines where they shall lie, is altered, their position will alter in accord.

If the rotation slightly decreases in velocity, then the belts will be less intense. Thus there will be less warm air driven to the pole and the temperature there will fall greatly. We shall thus tend to get the zonal type of climate, which we are experiencing at present. But a survey of past time shows us that a uniform distribution of heat has been more usual on the whole.

And Producing Crustal Stress and Mountain Building

As stated previously, there is a close connection between mountain building and the periods (late Proterozoic, Devonian, Permian, and Tertiary) when ice ages and the zonal climates obtained.

If the earth's rotation decreased slightly, the bulge at the equator would certainly tend to flatten out. The globe projects here about seven miles as a result of the present rotation of 1,037 miles an hour. I have no data from which to calculate the effect of a diminution of angular velocity of even one mile an hour on the shape of the earth. It is logical to assume that under such circumstances the lines of weakness would be affected by earthquakes and faulting, which, indeed, are prevalent in the present epoch. We should expect the less stable portions near the equator to collapse. There is evidence of this all through Tertiary times in the disappearance of the Antillean, Atlantean, and Malaysian continents. The temperate lands would buckle up—and we find that the major elevations along the Tertiary mountain ranges are in such latitudes, e. g. the Titicaca and Tibetan plateaus.

That there has been a periodicity in the development of the continents is revealed by Professor Gregory's comments in "The Making of the Earth."[47] He writes: "In the Lower Ordovician an almost complete reversal of land and water occurred," as compared with the present condition. This is just what the present hypothesis demands, for the Lower Ordovician is one of the uniform periods, while the present is a zonal period. At that time North America and Asia were covered by the ocean, and a huge continent connected Africa with Australia and obliterated the Indian Ocean.

Of the next uniform period, i. e. the Carboniferous, Gregory states: "There is even clearer evidence of the recurrence of the Lower Ordovician arrangement, for a continent extended east and west across the southern hemisphere." This continent is known as Gondwana Land.

It seems evident that there is a sort of migration in the continents also. During the uniform periods equatorial lands appear to be very slowly built up, but these disintegrate rapidly (as ridges and fault blocks) during the zonal periods. This occurs especially along the equator, the lands "flowing" toward the higher latitudes. There is obviously much remaining to be explained which is not accounted for by any hypothesis to date.

Under these circumstances the most ancient relics of the crust might be expected to occur in its least disturbed portions. These would probably be in the region between latitudes 45° and 75°. At any rate here occur the chief coigns, or shields, of Archean age, which have remained more or less unaltered throughout the geological record.

It is to be noted that there are no southern lands corresponding to Canada, Russia, or Siberia, except perhaps Patagonia. Hence we are compelled to base our hypothesis almost entirely on northern hemisphere data, as far as these latitudes are concerned.

Explanation of Warming-Up After the Ice Ages

This suggestion—the retardation of the earth's rotation—gives no clue as to the warming-up which seems to follow the ice ages. Probably it is not a general warming so much as a redistribution of heat whereby the world slowly returns to the more normal uniform arrangement of temperature. If we can assume that the heat energy of the world is practically unaltered it may simplify the problem.

It does not seem possible that the earth's rotation accelerates again after the zonal period is over; though, as noted above, the equatorial lands seem to arise periodically. The initial rotation is determined by the conditions governing the birth of the planet, and almost all succeeding influences can only retard that rotation.

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[47] J. W. Gregory: The Making of the Earth (in series: The Home University Library of Modern Knowledge No. 54), London and New York, 1912, p. 180.

It is to be noted, however, that the shrinkage of the earth's crust implies a greater speed of rotation (in accord with Kepler's Equal Area Law). Furthermore, we may note that it is possible that the radioactivity of the earth is gradually stimulated by the great deformations of zonal epochs and gradually heats the earth up to its average temperature.

Lest these suggestions appear too speculative, we must remember that the average decrease of terrestrial heat—whatever it may be—has resulted because all these factors have come into equilibrium in the course of aeons and aeons of earth history. The small interval of 300,000,000 years (which is all we have knowledge of in the fossil record) is insignificant compared with the whole life of our planet. Furthermore, we should remember that the maximum temperature change at any one place (at sea level) throughout the time we are considering is only about 15° Centigrade, which, again, is insignificant compared with the range of temperatures in the solar system.

Possible Astronomical Causes of the Earth's Retarded Rotation

What has caused the retardation of the earth, if such has occurred? It would seem to be due to a tidal action which operates in two cycles, one in every 200,000 years and another every 150,000,000 years. This may indicate stellar interference. I hesitate to make any suggestions—for astronomy lies beyond the province of a physiographer, though it is necessary to include most sciences within the scope of his purview! However, the peculiar form of graph which I illustrate in Figure 13 would result if we assume the following conditions.

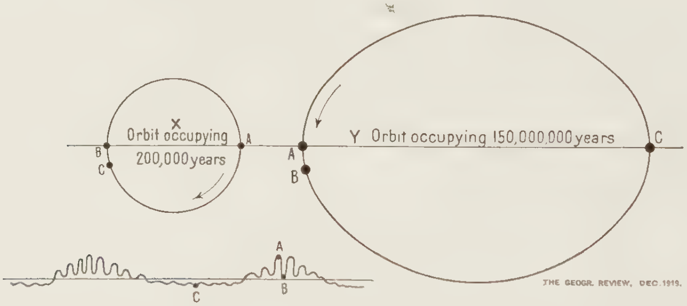
X
Orbit occupying
200,000 years
B
C
A
Y Orbit occupying 150,000,000 years
A
B
C
A
C
B
THE GEOGR. REVIEW, DEC. 1919.

FIG. 13—Diagram illustrating the hypothetical interference of a stellar body Y upon a stellar body X, giving rise (in X) to the cyclic curve shown below to the left.

Let us imagine a planet or star, X, which has an orbit that it traverses in 200,000 years (see Fig. 13). Let us further postulate another infinitely greater star or planet, Y, with an orbit occupying 150,000,000 years. When Y is at its farthest point from the orbit of X, it will have very little effect on the latter. As Y comes nearer, its effect will grow more marked every 200,000 years as X swings past its "perigee." Finally, when X and Y are at their nearest points of approach, both cycles of tidal action will be at their maximum. If we imagine that X corresponds to the solar system and that Y corresponds to some unknown star (now 100,000 years away from its nearest position to our system), my meaning may become plain.

It is usually assumed that the solar system is moving through space at the rate of about 11 miles a second. Some astronomers suggest, moreover, that the path is not straight but forms a closed orbit round the Pleiades. Whether this vast celestial revolution has any connection with the periodic cycles which I have endeavored to demonstrate in this paper is a problem which I leave in the hands of the astronomers.

Part VII

Summary

1. The world is at present passing through the Fourth Interglacial Period of the Pleistocene.

2. Temperatures as a whole are slightly warming, as if we had not yet reached the center of the Interglacial.

3. Hence the climatic belts are moving poleward from the equator. The desert region is encroaching on the southern coasts of Australia. The northern littoral is becoming wetter.

4. In the four ice ages of the Pleistocene the converse was true. The southern littoral was wetter than now, and the desert belt was nearer the equator. This ''swing'' occurs in the northern hemisphere also.

5. The control of historic civilization by the polar march of the belts is very marked, especially around the Mediterranean.

6. A survey of the effect on the Pleistocene history of man shows that there have been four great migrations (due to the four glacial ''thrusts'') from Central Asia, corresponding to the four earlier races of man—the Negrito, Negro, Hamitic-Iberian, Aryan.

7. These migrations all followed along the chief land routes, or ''corridors,'' and reached Africa and Europe, India, Malay-Australia, and America (e. g. Botocudo and Yahgan).

8. Traces of the Negroid migration are found in South America as well as in other ''peninsulas'' where they have been ''pushed to the wall'' by stronger and later races (e. g. Botocudo ''Australoids'').

9. The last (Würm) ice age thrust out the early Aryan races (olive) not only to India, Europe, and Africa but also into North China and Japan. A number of migrants reached America and are to be traced in the tribes of Brazil as well as in the Algonkians, etc., of North America.

10. Differences in color are connected with the climatic changes in the great Asiatic breeding place (Aralo-Persian region). The hot moist climates produced red-brown races; the cooler moist regions produced olive-brown races, the arid warm regions produced yellow peoples. These races all darken (tan) if they live long in a hot region and bleach (toward white) if they live long in a cold moist region.

11. The ancient cultures can be recognized all over the world and agree with the prehistoric evidence of western Europe and North Africa. Thus the migrations of the ''Stone Monument'' peoples are identified by the presence, in the skeletal remains of its

members, of an extra trochanter, or process on the thigh bone, in Belgium, Japan, and Patagonia.

12. It seems possible that the last typically yellow races were developed in an unfavorable region and are hence somewhat stunted. The upper-class (pale olive) peoples of China and Japan belong to the same migration as many Europeans. It is quite illogical to say the white man has developed from the yellow. One might just as well derive the negro from the white.

13. Turning now to earlier geological periods we find well-marked ice ages (before the Pleistocene) in the Permian and at the dawn of the Cambrian (late Proterozoic). There was also a third at the end of the Silurian. These four epochs are equidistant in the geological record (as far as evidence goes) and they are perhaps 100,000,000 years apart.

14. There is a well-marked alternation through the ages of periods with sharply differentiated climatic belts (*zonal*) and of periods with almost *uniform* climate throughout most of the world. We are living in a zonal period near the glacial culmination. Warm uniform climates occurred in Ordovician, Carboniferous, and Triassic.

15. The north temperate region passes through a cycle (each 100,000,000 years) from ice age to ice age as follows:

I. Cold wet ice age, mountain building, volcanic action, end of biological era. (There are probably interglacials as in Pleistocene.)
II. Warmer and drier, new genera in great numbers, some mountain building.
III. Warm arid, red sands, salt deposits.
IV. Uniform warm climate, coal and corals in polar regions, great peneplains.
V. Like III.
VI. Like II (except for life types).
VII. Like I; end of era.

16. In the Proterozoic we have evidence of two more cycles, probably of equal period.

17. The last ice age caused the development of man. The Permian is soon followed by the first mammals; the Silurian is followed by the first vertebrates; and the late Proterozoic by the well-known enormous increase in life.

18. As to the *causes of these cycles,* the following suggestions are made:

The alternation of zonal and uniform climates seems to be due to a decrease in the poleward flow of tropical air. This would follow on *retarded rotation* of the earth, for the dynamic circulation would decrease.

19. The coincidence of ice age and mountain building is very significant. The retarded rotation would cause the equatorial bulge to move poleward and induce great folding and volcanic action.

20. The change of the continents from equatorial to temperate belts seems to be indicated in the past record.

21. This theory gives no explanation for the increase in temperature after the ice ages. Possibly it is due to shrinkage in the crust (which would increase rotation), combined with increase in radioactivity (consequent on crumpling, etc.), so that a balance is arrived at not much, if any, colder than before the ice age. (Relatively minute temperature changes are all that is required.) The periodicity may indicate cosmic interference, no doubt affecting the sun also.

THE LAST EXPLORATION OF LIEUTENANT MARQUES DE SOUZA: DIARY OF A JOURNEY ON THE ANANÁZ RIVER, BRAZIL*

PART II

The earlier instalment of the diary of Lieutenant de Souza, published in the preceding number of the Review, *brings the narrative of his difficult journey down to the point where he begins to encounter the long series of falls and rapids that interrupt the Ananáz River midway in its course. His real difficulties now begin. Canoe after canoe is lost, the food supply at times gives out completely, and the Indians become a grave source of danger, finally attacking the party and killing Lieutenant de Souza and others. But for the lucky escape of one of the men who was absent on a hunting trip, the diary of Lieutenant de Souza and the manner of his death would have remained unknown.*

DISASTERS AT THE "NINTH OF APRIL" FALL

April 10. At 6 o'clock we began to move the baggage around the fall on the right bank, just above the smaller fall and just below the large one. There is an abundance of *borrachudo* gnats, which attacked us without mercy. We used the Indian road to transport the canoes. These Indians, according to the information of the Nhambiquaras, are *cocorêo* (very wild) and call themselves Tchêlêpnindê. Everyone who has told us about these Indians has begged me to shoot them on the spot, if they should take hold of the rifle I always carry with me in my tent and should point it and say "pun-pun-pun." From this I concluded that they were very treacherous. At 5 o'clock in the afternoon there happened a thing that we had never expected. We went out in the small boat with the kitchen material in it, and behind it followed my boat from which I made the survey. I had taken three sights and was taking the fourth when Candido, who was in the small boat, warned us to look out as there was a fall. We soon saw him going down with João Peru, and in a moment the boat containing all the cooking utensils, two rifles, two battle axes, and three axes, was full of water. We hardly had time to turn our boat, for the current was tremendous. Thank God, though we continued going down stream, we succeeded in catching hold of limbs of trees and were able, with great difficulty, to stop the boat. At this landing we set up the camp. The two boats behind, which were bringing the supplies, stopped at our call and did not suffer any damage. After some moments poor Candido and João came along, the former with the sack all wet, and the latter with the oars and a kitchen pan also full of water, tired out by the struggle they had had in the midst of the rapids. We thus lost several essentials: two rifles, the kitchen utensils, three axes, two battle axes, many small kitchen utensils, and the boat. They told us that their boat had got jammed between two rocks and that, with effort, it might be released.

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* Translated from the Portuguese and published in the *Geographical Review* at the request of the late Colonel Theodore Roosevelt.

I am very sorry to have lost my best rifles and my tools, for now we have only one ax and four short swords to make boats with. By 7 o'clock at night we had transported to our camp all the baggage of the two boats that stayed behind.

April 11. Early in the morning we went to see if we could save that boat. Fortunately, after breaking our last rope and using our last resource, we succeeded in dragging it by a double cord to the bank of the river. Before this, however, Manguary and João, with great difficulty but with great courage, succeeded in catching hold of the other boats which had not yet capsized. Thank God, we got out the rifles that belonged to Candido, the three axes, and one short sword. We were very glad of this and soon began to transport the canoes around the fall. But, unfortunately, we lost the boat that I was using. Bernardino and Bahia, frightened by the danger which threatened them from the strong current, let go of the boat and succeeded in saving themselves. I soon became resigned to this misfortune and, as I was already tired, ordered breakfast and soon afterward requested Terto to look for a cashew tree, a *guanandy*, or some other timber that was suitable for a boat. The other men continued to open the path, for the Ninth of April Fall continued. At 12:30 I heard shots and was a little apprehensive but soon saw, by their continuation, that the men had found a colony of monkeys. A half hour afterward two men were bringing five enormous *barrigudos*. That was a *fiesta* day.

Increasing Illness and Meager Food

April 12. Yesterday passed without any notable incident. Only I became a little worse, having vomited at night. We moved today to Camp No. 25, a spot above the last fall, which has an average height of two meters; at this place there is an *igarapé* on the left, six meters wide, and one on the right, ten meters wide. The first boat has already been transported. Tomorrow the other two will go, and we shall begin to make one for me. Thank God, I have been better today.

April 14. The men have transported the canoes to a place above the great fall, and my canoe is already dug out. Not until after we have finished it shall we transport it below the fall. I am very eager to continue the trip, for the men, besides being weak and working constantly in the sun and rain, are ill.

Today the number of sick men has increased; there are three: Victorino, Manguary, and Bahia. The last-named is completely prostrated. There are moments in which, if I were weak-minded, I should lose courage. What gives me most care is the lack of food. In the other camp we killed some monkeys, but after that, nothing.

Breakfast and dinner: *farinha* and rice. Today Victorino went fishing below the falls; but the fish merely approached the hook and then darted away. Fortunately Candido killed today a *mutum,* which served for a dinner for ten men, and one *barrigudo* monkey, which will serve for our breakfast tomorrow. I only pray God that he will give me health to continue the voyage. There is not a single man that has not been sick; and we continue on without knowing where we are going. I wonder if we shall ever reach the Madeira.

April 15. Fortunately tomorrow we shall finish the boat. There remains only the work of transporting it below the fall and of making five oars. I think that on the 17th we shall set out. Today one more on the sick list: the old master workman, Terto, who, although he is sixty-two years old, is worth more than many young men. Victorino is worse and also Manguary. My God, what a situation this is! To see the men sick without resources! Day by day I pray God that I may get to the Madeira as soon as possible, in order to go on home and leave forever this life of the "Wandering Jew." I have experienced everything and can now form a true idea of this wilderness life. Only one who finds himself in my position is able to calculate the enormous difficulties that are constantly arising and that have to be overcome, under the penalty of losing one's life.

April 16. The men continue ill, while the boat will only be ready tomorrow. Victorino and Manguary are better. God grant that they may all be well tomorrow so that we may transport the canoes. Today João and Candido went hunting and succeeded better than yesterday, for they brought in a pig. They found a great Brazil-nut grove but not a single nut. There were heaps of hulls under every tree, a proof that our kinsfolk [i. e. Indians] were the despoilers. When we found the *tocarys,* we were more contented, because that is good food.

Reducing the Baggage

April 17. The boat was made ready. It is as infirm as the master workman Terto. Indeed, what shall we do? We have to accept things as they are and not as they ought to be. I shall have to reduce the baggage. With the data I have, I have just calculated how long it will take us to get to the Madeira. It will take, if we are fortunate, one month. I have been eager to get there by the 22nd of May. We shall see. I shall consider myself very fortunate if I succeed. Thus I shall be able to get to Manáos before the 10th of June. On the 3rd of July, God willing, I shall dine with my people. As it is the birthday of my brother Edward, it will be a great day, for, if Caio comes, we shall have a family reunion. My stomach trouble is worse. I haven't been well all day, and that itch has troubled me a great deal.

April 18. We have been nine days at these falls without the possibility of going on with the voyage. In the first boat wreck we lost the kitchen utensils and other small articles, saving the boat. In the second we lost one boat and four oars. Fortunately I think today is the last day that we stay in this camp, for the men are better and this morning are transporting the canoes while Master Terto is making oars. We are going to reduce our baggage considerably at this point, first abandoning the awning, which occupies space and weighs a great deal. Of our supplies only a little remains. We only have *farinha* enough to last till we find other resources. Coffee we have in abundance. We shall abandon sixteen kilogram cans. Of rice we have four cans, which will last for eighteen meals, and seven kilos of sugar. This is what we have for our voyage.

The Plague of Insects

If we find more falls like this one, we shall be unlucky, and, in that case, it will take us longer to get to the Madeira. I do not know, O God, how we shall get there. I am not well and, besides being weak and unable to walk, tire very easily. I have spent these days under my mosquito net, owing to the attacks of those terrible *borrachudo* gnats. The men go with their feet all wrapped up in rags and their heads covered with a cloth through which you see only the eyes.

This is a horrible thing. From our first camp to this one we have been persecuted by a thousand varieties of mosquitoes, *carapanás, motucas, carrapatos* (ticks), *cupíns* (poisonous ants), *mucuins,* bees, ants, etc. What a terrible plague! We nearly finished the transportation of the canoes. Only the *Minas Geraes* robbed me today of much time. I shall see if tomorrow by midday I can transport the baggage to the landing place where the canoes are and if Master Terto will give me two more oars by that time for the trip. I desire to be well rid of this waterfall, and of its hoarse roar. Today is Sunday.

Loss of Boats

April 20. I thought I would move the camp yesterday and go on with the voyage. The baggage was already transported, my awning reduced to half, and indeed everything was ready. I only waited for the two boats to be taken over a small part of the falls, and receive the baggage. The two boats, lashed together, were being towed with a rope; but, behold, water was getting into the small one through a punctured place, and the force of the current, which was very great, would not allow the men to pull it to shore with the rope. The moment was a critical one. The rope broke and the boats, together, were swept over the falls.

The men were saved, but the boats got between the stones, and, although we made desperate efforts to save them, all was in vain. Soon afterward we began to make a raft of *buritys,* but this morning we saw it would not do. Then Master Terto went with the three men to find a cashew for another boat. Up to 8 o'clock at night the man has not returned, as it was agreed he should, to inform me that a tree had been found. Evidently they have walked the woods all day without success. God knows they may have to spend tomorrow without success. It would seem impossible for me to have lost three boats at one waterfall. My situation is a very serious one, and it becomes necessary to act with calm and do nothing with precipitation, under penalty of a grave disaster. What will become of us?

Impatience at Delay

April 21. What a horrible situation mine is! To desire, to be under imperious necessity to get on down the river as fast as possible, both on account of our health and on account of the scarcity of the supplies, and not to be able to do so for lack of boats, is a most distressing situation, and to endure it one must have great courage.

Not a single moment passes that I do not think of our condition. I wake up from sleep frequently, always thinking about the same thing. I make a thousand suppositions, at times absurd ones; but, thank God, I do not lose courage. Let us wait for the messenger that Master Terto was to send, and we shall then know what is to be done.—10 P. M. Laurindo came a short while ago to inform me that they had found a cashew 15 palms (10 feet) in circumference, sufficient to make a very large boat. Near this one there are others, 12 palms around. The baggage has already been transported to a place opposite the cashew tree. *Farinha* is the only provision we have. If we have no more delays at falls and if we are lucky with our health, I think we shall not get to the Madeira before the end of May or the beginning of June.

I imagine how my mother and brothers must be distressed at not receiving any news from me in May. What could I do? No one is in a greater hurry than I to get to Manáos, for I fear my health will get worse. I shall put forth every effort and hope God will grant me success.

A New Boat Built, Lost, and Recovered

April 24. We moved camp on the 22nd. On the 21st Master Tertuliano, with the men, cut down six cashews and found them all hollow. Happily on the morning of the 22nd, they found one, 16½ palms in circumference, that was sound. The canoe is nearly ready and is 35 palms long and 4 palms wide. The men are in a pitiful state. Our food is *farinha* with *pataua.* I have three hunters, and at times they bring in only a *jacú-tinga* or an *urú,* as today. Sometimes I feed on *farinha* and coffee till the afternoon. My God, what a horrible life! Besides this, the men are weak, covered with sores, and sick. Only God knows how I am. I fear some complication of the bowels.

April 25. The men took courage today from a visit of *barrigudos* to the place where the boat lies. Five of these monkeys were killed on this occasion by João, Aristoteles, and Bernardino. This means we shall have meat for breakfast on the 27th. Today a passing incident took place that gave us some concern. In the morning I sent Candido, João, and Aristoteles (Laurindo) hunting below our camp. The other men having passed the night here, I went with them early to the place where the boat is being made. On arriving there we discover the *barrigudos,* and Bernardino, after seven shots, brings one down. The hunters immediately supposed we were shooting the monkeys and came in the direction of our shots, leaving Candido with their boat. As his *camaradas* delayed in returning, he too came over to us, leaving the boat tied. An hour after he returned and found the boat had disappeared. It had gone down the river. At this point Aristoteles and João came and gave me notice of the incident. God knows how I felt.

Was it possible I should have to delay here longer to build another boat? I did not rest till, an hour later, they brought me the lost boat. What moments one passes in this kind of life!

Numerous Shoals and Falls

April 30. On the 27th I camped in the "Port of the Large Boat." The boat was got ready on the 28th; it carried all of us and all the baggage. On the 29th we set out at 3 o'clock. After traveling forty minutes, we had passed three shoals and had seen two others and one fall below us. On the 30th, after transporting the canoes, we carried the baggage to a place below the fall. This work was ended by 4 o'clock, and soon afterward it began to rain hard.

May 1. 9 A. M. Camp No. 28. I went out at 7:30. After rowing half an hour we heard the roaring of a waterfall and, for precaution, I sent a man ahead to look it over. This was at 8 o'clock, and before 9 I had learned of the existence of two falls, making it impossible to navigate here. We tied up on the left bank, where there is a little open field easy of access. We carried the baggage there and set up the camp on a beach just below the second fall, which is 1½ to 2 meters high. The river is broad, and the spot is very pretty. We expected to continue the trip, but it was impossible. The men fortunately succeeded in landing the canoes above the second fall, and tomorrow we shall undertake to move them overland. It seems almost incredible that since April 10 we have not traveled two hours a day. We have shoals, rapids, and now falls, in quick succession. When shall we end this interminable struggle? I wonder if we shall find more falls after these two.

May 2. Not till afternoon did we succeed, with much labor, in transporting the two boats around the falls. We hope to set out early, to see if, perchance, we may travel one or two hours. I suspect we are about to come to a high fall, for there have been no fish. When will that joyful day come when we shall have ended this horrid trip?

May 3. We began our activity at 4 o'clock in the morning and at 5:30 we began the voyage. All were hopeful of not meeting any more falls (the land being flat) for the rest of the day. But lo! at 8 o'clock we were halting in order to explore the river ahead of us, for we heard the roar of rapids and falls. At 9 o'clock I was informed that the men had walked more than a kilometer along a succession of falls and cataracts.

Transporting Baggage and Boats Around Falls

We then went into a side arm of the river and unloaded the boats. Not satisfied, I sent João to explore the river, while the men transported the baggage below. At 12:30 the men returned, and João also at 1 o'clock. He told me that the whole region was full of falls; that there was a great fall, 10 meters high, farther down; and that he heard the roar of still other falls below. At 4 o'clock the baggage was in our Camp No. 29, and the men had found, lower down, an *igarapé* 10 meters broad. What shall we do with our boats? Shall we make others and leave these? We will decide tomorrow. Today Candido and João killed thirteen *jacú-tingas.*

May 4. Camp No. 30. We moved to this camping place just below the great fall and on the left bank of the river. Our blazed path runs along the river, and one may see now and then picturesque and most beautiful spots. I have not seen the great fall yet, because, when I got here, my legs had about given out and were aching. João went as far as the last shallows, nearly a kilometer from here. From there, after examining everything, he went on down the river, which improves; for no more noise of falls is heard, and the water runs slowly. Tomorrow we shall begin the transportation of the boats through the falls. I expect I shall lose them, for the passes are very difficult, and there are sections over which they cannot be carried on land because of the rocks and the nature of the ground. God only knows when we shall get away from this place. I judge that these last breaks are spurs of the Serra do Norte; if so, the river will grow better, and we shall finish our painful voyage in a little while.

Discouragement in the Camp

May 5. We took the boats as far as Camp No. 29 near the first fall; we expect to carry them by land tomorrow, and, as there is a great deal to be done, we may stay here several days. Food is scarce, and the men have become discouraged, for we had not found a single *patauá* nor a Brazil nut. Today, however, Candido, João, and Manguary found an abundance—enough to take their breath away.

Today at 12:30 Master Terto came to the camp in discouragement with a cowardly suggestion that we abandon the boats and make new ones of cashew or chestnut. I had less than my usual patience, for the adversities of this exploring life are extreme. I told him to go back and transport the boats even though it should take fifteen days, as he thought it would, to put them below the great fall. I continue ill; my abdomen is terribly swollen, hard, and sore; my legs are weak, and there is a kind of numbness in my whole body.

How many efforts I have made to hasten my trip! And all nearly in vain. One has to have great resignation and much courage not to give up.

Shooting the Boat Over the Fall

May 6. Early today the men went on ahead with my orders to begin the transportation of the boats, to have a good start by the time I arrived. I ate some nuts and *farinha,* had coffee, and went after them. On arriving at the fall near Camp No. 29 to my amazement I saw that Manguary in the prow of the large boat was descending the little fall. A little afterward he dashed over and, still in the prow of the boat, ran aground just above the great fall. Phlegmatically he stood looking over the big fall with the indifference of one who might simply calculate its height and say to the river, "Now come on, float the boat, and take it down the tumble." After fifteen minutes it dashes over, sinking and breaking—the rope at the prow was secure to the right bank of the channel. When it submerged he loosened the rope, let the boat go farther down, and tied it. Then he leaps into the full current, dives, and succeeds in descending with the boat till the rope is very taut. A half-hour afterward we were bailing out the boat on the left bank, where I and the men were standing. Afterward he and Aristoteles said to me they were going to descend the other fall of the channel in order to be just above the second cataract. I considered it foolish but, as they assured me there was no danger, I yielded.

At 3:30 the boat was on the right bank, run aground, near the entrance of the second cataract. The two went across the river, and tomorrow we hope to be favored again by this breeze that blows good fortune. Perhaps tomorrow the boats will be below the last and greatest of the cataracts. I shall give thanks to God if we are successful in this last crossing, for I am anxious to go ahead and I continue ill. My legs are worse; I am not able to walk fifty meters without getting tired. If I go ahead, it is by holding on to bushes and limbs of trees. When shall I be with my people? Oh, how much have I thought about them! and how many air castles have I built! This is the last time I will leave my family and throw myself into risky undertakings like this.

Fever made me today one of its "rare" visits but did not leave me prostrated as formerly. In the morning I went out with the men to draw out the big boat that had been submerged among the rocks of a little cataract. I felt ill and returned to the camp a little while afterward discouraged from seeing that it was difficult to get the boat out and that a delay might be necessary.

At 10 o'clock Manguary arrived and informed me that, after a great struggle, they had hauled down the boat that was at the falls just above our camp. I was very much gratified. At 3 o'clock it was below the landing at the side of the other. Tomorrow we shall make some oars, for we have only three. Today we had no game; what came to our aid was the nuts and the *patauá*.

REFLECTIONS

Only one like myself, isolated and alone in the world, without a single friend to whom to confide what I feel, can fully understand this page of intimacies. I am entirely cut off from everything, my supplies are scarce, and I am ill, constantly suffering, and facing ever-increasing difficulties. Indeed, obstacles rise up at every step, impeding the continuation of this afflicting voyage. And to think we have not made half the distance yet. Oh, how sad is our situation and especially mine! One who, like myself, behind an apparent indifference, idolizes his family and friends, cannot, in this wilderness of the Brazilian west, keep from shedding some tears—tears of homesickness, tears apprehensive of the health and happiness of his own. Who is it that would not, like me, shed such tears? And furthermore, who is there that would not think of the most intimate facts of his home? Constantly I imagine myself there. Today, for instance, is Sunday, the day of rest. In the morning I seem to see my mother and the girls getting ready for mass and Edward and Henry going to the bath; after mass the customary chat at the front door. Indeed it would be irksome to enumerate everything.

Breakfast, the luncheon, the afternoon dinner—all these scenes pass before my eyes as if I were seeing motion pictures.

And . . . even Dr. Angelino awaiting Monsenhór Marinho. These are the scenes that contribute to make my eyes shed tears, which glide burning, one after another, down my face.

What I have said does not denote a weakness of soul; it is not fear. Though sick, and the sickest of all the party, I am the most cheerful and from time to time speak words of enthusiasm to the men or make a joke that disciplines somebody, and I always seek to encourage them to go on with the journey.

CLEARINGS AND VESTIGES OF INDIANS

May 9. Owing to the lack of oars we did not leave today. Candido, while hunting today, came up with eight clearings on the left bank of the *igarapé* near its headwaters. Two large ones were in the center, and the others around them. They were made by brute force and only last year. We have also found old vestiges of Indians, and I am glad of this. I pray God I may not even see them.

May 10. Camp No. 31. Although fever visited me early today, we began the work of transporting the baggage from the boats. We went out at 4:30, and at 5:00 we passed on an island the last shoals in this long section full of falls. Tomorrow we shall transport the baggage and the boats. I wonder if we shall travel a whole day without meeting any falls?

May 11. We traveled today without interruption from 7 o'clock to 10, when we twice had to transship our cargo. At 5 P. M. we set out from the last shoal (second transshipment), and at 5:15 we stopped above another to begin our perpetual struggle again in the morning. Today we have made the greatest distance since April 9; we have gone 20 kilometers. We have had a (successful) hunt, thank God! Today we got two little *piaus* and a big fish . . . . . . Assuredly there are great falls below, which prevent the fish from coming up the river. In this camp there is a drinking place which attracts deer and tapir such as I did not suspect existed. It must be visited by many of these beasts. One hundred meters in the interior João encountered eight Indian huts made the past year. Of them all only one was made of the *assahy* leaf, the others of the *pacoba* leaf. At the thirtieth position that we fixed we encountered old remains of our kinsfolk [i. e. Indians] and among them a tree of 40 centimeters diameter which they had cut down with a stone ax for gathering honey.

FREQUENT RAPIDS AND TRANSSHIPMENTS

May 12. Camp No. 33. At 7 o'clock we transported cargo by land and set out. Passed six shoals and a little rapid with a fall of 5½ meters. Transshipped four times; at 4 P. M. passed a shoal and immediately saw another large one, but a channel gave us passage. Thus we avoided it, although the passage was difficult. After the crossing a heavy shower fell, and, as it was very dark and the river was full of stones, we landed all wet. We finished our meal at 8:30. Today we killed only a *bigua!*

May 13. Set out at 6:30 and at 6:15[?] landed below a great pool where the river has a width of 200-250 meters. Passed by sixteen shoals and two falls, the first 1.50 meters high, the second 0.6 meter. Transported the cargo twice, the second time at 4:30, at which hour we breakfasted. Calculated distance traveled about 24 kilometers.

May 14. Set out at 6:30; at 7:15 first rapid; carried cargo over land. When the big boat was about loaded we heard João shouting for us to catch the canoe he had lost in the rapids. At that instant I saw it pass, prow up in the air. Immediately Manguary, Terto, Bahia, Bernardino, and Aristoteles were out to the rescue, rowing the big boat. What an hour I passed! I thanked God when they turned up bringing with them the runaway.

THE FIRST AFFLUENT OF THE ANANÁZ

We set out at 9:30, and at 11:30, below a great shoal on the right bank, we had the surprise so greatly hoped for; we saw the first river emptying into the Ananáz, about 25 meters wide more or less. Directly below, we breakfasted on an island and delayed in order to stretch the tents and dry the wet supplies.

At 1:15 I went out, and at 3:20 we stopped to transport the baggage at some shoals. At 4:30 we set out and at 5:00, after hearing a roar of a fall, we landed and passed the night in our Camp No. 35. I sent men by land to explore and learned of the existence of three falls and large shoals. We shall see tomorrow what we can do. Today we saw new signs of kinsfolk.

May 15. Camp No. 36. Soon after daybreak we began to work. We went down half a kilometer and tied up to the left bank, transporting the baggage soon after. The land is very irregular and dangerous. We easily transported the baggage through the marginal channels. The first, though only half a meter deep, was the most dangerous, and the last, which was near 1.30 meters deep, was better. At 12:30, having breakfasted, we set out, thanking God we had passed this section, so full of falls, without trouble. At 1:30 we came upon another fall. After we had carried the baggage along the bank, the boat easily descended the stream, and at 3 o'clock we set out.

Living on a Diet of Nuts

As we had nothing for dinner, at 3:50 we stopped in a small nut grove, and, although we made thorough search, we gathered only half a sack of nuts, of which two-thirds were spoiled. At 4:30 we left and soon stopped in a large nut grove, where we supplied ourselves with nuts for dinner. We put up just opposite a good clearing, and now at 8 o'clock the men are all busy wrestling with a dinner. Raw nuts, baked nuts, stewed nuts, grated nuts, nut porridge, and nut milk—indeed today it is nuts in every style. There is no sign of bait for fishing. My dinner consists of a *farofa* of grated nuts, *farinha* roasted, and coffee. We have recently been little visited by the *borrachudo* gnats; but the purple butterflies and, at night, the ants and *cupíns* will not leave us. The plague always! . . . .

May 16. Camp No. 37. This endless series of falls continues still. We transported the baggage and passed around three falls, the two highest reaching a height of 2 to 2½ meters. We have passed two other falls and five shoals. We hardly get away from one before we hear the roar of another. Today we put up just below a cataract 2½ meters high on a side stream. The large boat remains to be taken over tomorrow. We did not have time today.

We are feeding on *farinha* and nuts, and this fare has done me much harm. I have tightened my belt a great deal. We killed nothing today.

The Falls Become More Difficult

May 17. Camp No. 38. Not until midday did we leave Camp No. 37 after we had taken the large boat over a little side fall. We traveled only

30 minutes. After this little voyage, in which we passed two shoals, we were obliged to halt again just above a great fall, more than 8 meters high. We examined the land and verified the impossibility of transporting the boats either by land or by water, for the land also is very irregular. It is a mountain range, which the river cuts through, the banks being 10.35 meters high. Only by the help of God shall we be able to save our boats. The small one with great risk and difficulty may pass through the falls of a side stream, but the large one will not. So we have decided to let it go tomorrow over the great fall, there being a probability of saving it if it does not break in falling. If it does not break it should stop in a large pool where Manguary and Aristoteles will stand to catch it and float it to the right bank.

Our situation is precarious, for we have had no game nor fish for three days, and our *farinha* is reduced to a small quantity. Tonight Victorino went fishing and caught nothing. Brazil nuts are our principal food, although we are already suffering from having eaten them. I have grown worse, for my bowels are very sore and badly swollen. We are compelled to resign ourselves to staying here eight or ten days more! I can imagine how mother and the girls are looking for me in May! Not till June or July shall I be able to get to Manáos, but . . . . God is great and is able to be moved to pity by our situation.

May 18. Here at Camp No. 38 we shall remain a good while longer. All hope of saving our canoes has gone. Our last one was soon full of water and was caught between two rocks and cannot be extricated. The small one remained above the fall; it absolutely will not pass. We shall begin to make new ones today. The worst is that we have nothing to eat. Still God is great and will not forsake us. Victorino succeeded in catching seven fish, and the five men who went hunting brought in two birds. Master Terto did not find cashew trees for the boats. Tomorrow we shall avail ourselves of our last resort, which is to save at least the small boat.

May 19. In spite of the rain we started early on the task of transporting the small boat. The ground is very hilly, and it was very difficult to drag the boat on land, for the rope was rotten and broke three times. We had to give up this rope and use a roll of American line, which, being too small, we doubled four times. Fortunately, with much effort, by 3 o'clock we had the boat out of danger in our camp.

Safe Passage of the Boats

At 3.30 we made an effort to save the large boat, which the men had thought lost. Thank God, by 5 o'clock we had succeeded in getting it out of the water and drawing it on land at an island. Maybe we can save it. How everything changes from one moment to another!

We judged the small boat was lost; but I inspired the men with enthusiasm, and, behold, it was saved. Now what we lack is food, for we have not had any game. Even the nuts gave out today at dinner. I only pray God for help, so we may set out tomorrow and find something on the way, for we have nothing.

May 20. Thank God, by 10 o'clock we had rescued the large boat, but it almost cost us the life of a companion.

After passing the flagstones, Manguary, Aristoteles, and Laurindo, with wonderful skill, got into her, and the boat, carried forward by the great force of the water in a narrow channel in shape of an S, descended with almost incredible rapidity, hardly obeying the oars. João and Victorino stood on the bank to catch the ropes when thrown and to pull her toward still water. Unfortunately they were not able to haul her landward, and the boat, impelled by the force of the water, dragged the two men along and dashed against the rocks at the point of the island, splitting her prow and throwing Manguary into the water. For a moment he was out of sight, but Laurindo, with great agility, was immediately on the rocks and, rope in hand, was soon helping Manguary up. Then they hauled the boat back into the channel, but the strength of the current forced the rope out of their hands, and the boat rushed down the river to a pool where the men, by swimming, caught her again.

At 4:30 we set out and before 5 o'clock we had crossed seven shoals. We were then obliged to stop and wait until the next morning in order to transport our baggage across the island. *Farinha* and a few nuts are all the food in our possession. Neither game nor fish could we find.

Fall after Fall and Shoal after Shoal

May 21. At 6 A. M. we were up and ready to start with our baggage across an island just below our encampment. Fall after fall and six more shoals still appeared in our way, and, at almost every one, we were obliged to stop as before and examine the channels. At 2:40 in the afternoon we heard very distinctly the roar of a large fall and by 3 o'clock we were unloading our baggage at a spot 50 meters above it.

I was charmed with the beautiful spectacle before me. The river leaps from a high point, falling in a single stream a distance of 8 meters. There another fall is formed, having a considerable slope and only 4 meters high. Is it possible that we shall encounter more impediments and be prevented from continuing our trip?

During the whole of today we have traveled only one hour and twenty minutes and . . . we thank God for that! At last we were fortunate enough to catch our first *piranhas* (a kind of fish). Victorino has succeeded in getting us six of them, and they are nice and large. Candido and João have given us one *cojubim* and three *barrigudo* monkeys. I wonder how we shall come out!

May 22. We have done little today. Still we have transported the small boat over the flagstones at the big fall, and tomorrow I shall explore the river below our camp. Is it possible we shall still find great falls? It would seem incredible! We are now at the end of May and very far yet from any supplies.

After all, let us endure with patience and resignation, since this is our lot, and we shall work with pertinacity to fulfill our mission. How distressed must my family be for news from me!

Fresh Signs of Indians

May 23. After some effort we succeeded in transporting the boat, by land and by water, to our landing place by 3:30 in the afternoon. To get it over the flagstones at the big fall we had to make a kind of bridge. Tomorrow I hope to get the large one over and, God willing, we shall leave in the afternoon. This afternoon I sent Candido and Victorino in the boat to the other side of the river to hunt for nuts. An hour afterward they returned saying they had seen new signs of Indians there: a wigwam of wild banana leaves, badly made and showing that the leaves had been torn from the trees by main force; three great heaps of broken nuts; and three other old wigwams, one burnt. These Indians come from the region beyond, as the road indicates; and it is clear they are not acquainted with our implements.

Fortunate Passage of the Boat

May 24. From early in the morning we have been working to transport the large boat. By a tremendous effort we succeeded in dragging it to the bridge we made to unite the two flagstones at the fall. Just there it tumbled and landed below with the stern split. I have just left the men to cast it into the water. Very likely it will catch on some stone, and, in this case, we shall have to make another. We have done all we could to rescue it (12 o'clock). Our fare continues to be insufficient to sustain us. I am all gone with hunger. However, this is life; and I must be resigned to it.

By wonderful good luck we forced the large boat just below the great fall, and a few minutes afterward, as if guided by a human hand, it went straight to the channel of the second fall below. Taking the channel it descended and passed out of sight, to come to view again 300 meters away. There Laurindo and Manguary, jumping into the water, caught it just below our camp.

May 25. We set out at 5 A. M., and during the entire day we have not traveled ten minutes without having to stop to pass sometimes falls and sometimes shoals. Four times we transported the baggage by land and in the evening encamped on a little beach just above large shoals.

Our breakfast and our dinner consisted of a cup of *farinha.* There is not even a bird for bait. In the afternoon we passed an Indian footbridge. The Indians are near us, for we have seen signs of them recently.

Triple Falls at Last

May 26. We set out at 6 o'clock in the morning from Camp No. 41 and stopped in still waters near a lake where there are many fish. I sent Candido, Laurindo, and João to hunt and also to look for some nuts, for we have been out of these for a long time. Victorino and Bernardino went to explore the river below, for it gets much narrower and runs rapidly. Thank God, we have passed successfully the falls and the shoals. The men I sent to hunt did not bring back anything except a few nuts, and on these we made our breakfast. Just below our Camp No. 42 there are no less than three falls! It really seems a joke! I have not seen them yet, since my eruption will not permit walking; but I trust in God that we shall go on with our voyage and save the boats. What a horrible thing is this river!

We did not travel today more than ten minutes. At this rate when shall we get to the Madeira?

May 27. Camp No. 43. We are in camp below the last fall. The middle one is 2 meters high and the other two are about 1½ each. The passage of the last two is very dangerous, but I have faith in God that nothing will happen to us. The place here is like that behind us, very mountainous, but farther down it is level. The woods are better, and hills do not appear ahead. I am glad to say we had fish for breakfast, and for dinner the men ate a monkey. I only ate a little rice (from a can I had reserved for the sick) with nuts, for I was feeling very ill.

Another Disaster

May 28. We went this morning to transport the boats. The large boat on entering a channel at the first fall, owing to the current, got under way and, the men being forced to cast off the rope, ran down and stopped in still water between the second and third falls.

This smashed the prow, the bench in the middle broke, and the bottom split so as to leak slightly. The small boat, which was in still water above the second fall, also broke the rope that held it and was seen only once afterward. We lost the "*F*————————" —the veteran of the Ananáz—which .... with me the first days of the exploration in an Indian port. This occurred at 10 A. M. At 2 o'clock in the afternoon we had a fine cashew cut down to make another. Nevertheless, God is great and will not forsake us. This means four more days lost!

The diary terminates here. Recalling the hardships of one of de Souza's men who, after the Indian attack, journeyed alone for forty-six days more downstream, it seems probable that de Souza himself would have proved too ill and weak to stand the long voyage. His work must be regarded as an heroic pioneer endeavor. Until a first voyage, with all its hazards, had *outlined the main course of the stream, the nature of the country, and the character of the work itself, adequate equipment for the dangerous trip could not be provided.*

Like the Madeira and the Rio Theodoro, the Ananáz cuts athwart the old mountain axes that extend into the low Amazon country from the Brazilian uplands. It is at such places that the broken relief and the falls are encountered. The fuller history of these extremely interesting topographic relics will be one of the objects of later exploration.

Both Colonel Roosevelt and Colonel Rondon were recipients of the Livingstone Centenary Gold Medal of this Society and both took occasion to speak in the warmest terms of the work and sacrifice of Lieutenant de Souza.

THE NEW BOUNDARIES OF AUSTRIA

[With separate map, Pl. VI, facing p. 348.]

The new boundaries of Austria are defined in Articles 27, 49, and 50 of the treaty of peace between the Allied and Associated Powers and Austria signed at Saint-Germain-en-Laye, September 10, 1919. The accompanying map (Pl. VI) is based on the official text.[1] The boundary as there defined was plotted on the relevant sheets of the Austrian staff map known as the "Generalkarte von Mitteleuropa, 1:200,000," and, where necessary, on the "Spezialkarte der österreichisch-ungarischen Monarchie, 1:75,000," —the two series evidently used by the peace commissioners in formulating the boundary definition—and then transferred to atlas sheets in 1:750,000, on which scale the final drawing was made, to be reduced ultimately to 1:1,500,000 in engraving. Plate VI is, therefore, more refined even than the official map accompanying the treaty text. Although this is on a larger scale, 1:1,000,000, the new boundaries are somewhat boldly drawn and, in the segments consisting of drainage divides, rather generalized. The official map need not, however, aspire to extreme accuracy inasmuch as, according to Article 28 of the treaty, "in case of differences between the text and the map, the text will prevail."

In the following reprinting of the boundary-defining passages of the treaty text, a slight change has been made in the paragraphing. In the original the clause defining the end points of a segment of the boundary to be described and the clause immediately following describing the boundary between these end points are each printed as a separate paragraph. In our reprint the two clauses, for the sake of clearness, have been combined into one paragraph throughout.

Article 27.

The frontiers of Austria shall be fixed as follows (see annexed map):

1. *With Switzerland and Lichtenstein:*[2]

The present frontier.

2. *With Italy:*

From the point 2645 (Gruben J[och]) eastwards to point 2915 (Klopaier Spitz), a line to be fixed on the ground passing through point 1483 on the Reschen-Nauders road;

Thence eastwards to the summit of Dreiherrn Spitz (point 3505), the watershed between the basins of the Inn to the north and the Adige to the south;

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[1] Traité de paix entre les puissances alliées et associées et l'Autriche, protocole et déclarations, signés à Saint-Germain-en-Laye le 10 septembre, 1919. vi+vi+vi+536+4+4+2 pp. [Paris, 1919.] 12½×8½ inches. Text in French, English, and Italian. Accompanied, in pocket, by map, 1:1,000,000, showing the new boundaries on a transfer of a section of the Royal Geographical Society's map of Europe on that scale.

As a United States government publication the treaty text has appeared, in both cases without the map, in (1) *Congressional Record*, Sept. 15, 1919, pp. 5732-5779, and (2) *66th Congress, 1st Session, Senate Document No. 92* (the latter in a limited edition only).

[2] Liechtenstein is the official spelling of the principality.

Thence generally south-southeastwards to point 2545 (Marchkinkele), the watershed between the basins of the Drave to the east and the Adige to the west;

Thence southeastwards to point 2483 (Helm Spitz), a line to be fixed on the ground crossing the Drave between Winnbach and Arnbach;

Thence east-southeastwards to point 2050 (Osternig) about 9 kilometers northwest of Tarvis, the watershed between the basins of the Drave on the north and successively the basins of the Sextenbach, the Piave, and the Tagliamento on the south;

Thence east-southeastwards to point 1492 (about 2 kilometers west of Thörl), the watershed between the Gail and the Gailitz;

Thence eastwards to point 1509 (Pec),[3] a line to be fixed on the ground cutting the Gailitz south of the town and station of Thörl and passing by point 1270 (Cabin[4] Berg).

3. *On the south, and then with the Klagenfurt area,* subject to the provisions of Section II of Part III (Political Clauses for Europe):

From point 1509 (Pec)[3] eastwards to point 1817 (Malestiger),[5] the crest of the Karavanken;

From point 1817 (Malestiger) and in a northeasterly direction as far as the Drave at a point situated about 1 kilometer southeast of the railway bridge on the eastern branch of the bend made by that river about 6 kilometers east of Villach, a line to be fixed on the ground cutting the railway between Mallestig and Faak and passing through point 666 (Polana);

Thence in a southeasterly direction to a point about 2 kilometers above St. Martin, the course of the Drave;

Thence in a northerly direction as far as point 871, about 10 kilometers to the east-northeast of Villach, a line running approximately from south to north to be fixed on the ground;

Thence east-northeastwards to a point to be chosen near point 725 about 10 kilometers northwest of Klagenfurt on the administrative boundary between the districts of St. Veit and Klagenfurt, a line to be fixed on the ground passing through points 1069 (Taubenbühel), 1045 (Gallinberg), and 815 (Freudenberg);

Thence eastwards to a point to be chosen on the ground west of point 1075 (Steinbruch Kogel), the administrative boundary between the districts of St. Veit and Klagenfurt;

Thence northeastwards to the point on the Gurk where the administrative boundary of the district of Völkermarkt leaves that river, a line to be fixed on the ground passing through point 1076;

Thence northeastwards to point 1899 (Speikkogl), the administrative boundary between the districts of St. Veit and Völkermarkt;

Thence southeastwards to point 842 (1 kilometer west of Kasparstein), the northeastern boundary of the district of Völkermarkt;

Thence eastwards to point 1522 (Hühner Kogel), a line to be fixed on the ground passing north of Lavamünd.

4. *With the Serb-Croat-Slovene State,* subject to the provisions of Section II of Part III (Political Clauses for Europe):

From point 1522 (Hühner Kogel) eastwards to point 917 (St. Lorenzen), a line to be fixed on the ground passing through point 1330;

Thence eastwards to the point where it meets the administrative boundary between the districts of Marburg and Leibnitz, the watershed between the basins of the Drave to the south and the Saggau to the north;

Thence northeastwards to the point where this administrative boundary meets the Mur, the above-mentioned administrative boundary;

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[3] Peč on the 1:200,000 map.

[4] Čabin on the 1:75,000 map.

[5] 1801 (Mallestiger) on 1:75,000 map; 1817 (Malestiger Mittagskogl) on 1:200,000 map.

Thence to the point where it meets the old frontiers of 1867 between Austria and Hungary about 5 kilometers southeast of Radkersburg, the principal course of the Mur downstream;

Thence northwards to a point to be fixed east of point 400 about 16 kilometers north of Radkersburg, the old frontier of 1867 between Austria and Hungary;

Thence northeastwards to a point to be fixed on the watershed between the basins of the Raab and the Mur about 2 kilometers east of Toka,[6] being the point common to the three frontiers of Austria, Hungary, and the Serb-Croat-Slovene State, a line to be fixed on the ground, passing between the villages of Bonisfalva[7] and Gedoudvar.[8]

5. *With Hungary:*

From the point above defined northeastwards to point 353 about 6 kilometers north-northeast of Szentgotthard, a line to be fixed on the ground passing through point 353 (Janke B.), then west of the Radkersburg-Szentgotthard road and east of the villages of Nagyfalva, Nemetlak,[9] and Rabakeresztur;[10]

Thence in a general northeasterly direction to point 234 about 7 kilometers north-northeast of Pinkamindszent, a line to be fixed on the ground passing through point 323 (Hochkogel), then south of the villages of Zsamand,[11] Nemetbükkös,[12] and Karacsfa,[13] and between Nagysaroslak[14] and Pinkamindszent;

Thence northwards to point 883 (Trött Kö)[15] about 9 kilometers southwest of Köszeg, a line to be fixed on the ground passing through points 241, 260, and 273, then east of Nagynarda and Rohoncz and west of Dozmat and Butsching;

Thence northeastwards to point 265 (Kamenje) about 2 kilometers southeast of Nikitsch, a line to be fixed on the ground, passing southeast of Liebing, Olmod,[16] and Locsmand,[17] and northwest of Köszeg and the road from Köszeg to Salamonfa;

Thence northwards to a point to be selected on the southern shore of Neusiedler See between Holling and Hidegseg,[18] a line to be fixed on the ground, passing east of Nikitsch and Zinkendorf and west of Kövesd and Nemet-Pereszteg;[19]

Thence eastwards to point 115 situated about 8 kilometers southwest of St. Johann, a line to be fixed on the ground, crossing the Neusiedler See, passing south of the island containing point 117, leaving in Hungary the branch railway running northwestwards from the station of Mexiko[20] as well as the entire Einser canal, and passing south of Pamhagen;

Thence northwards to a point to be selected about 1 kilometer west of Antonienhof (east of Kittsee), being the point common to the three frontiers of Austria, Hungary, and the Czecho-Slovak State, a line to be fixed on the ground, leaving entirely in Hungarian territory the Csorna-Karlburg railway and passing west of Wüst-Sommerein and Kr. Jahrndorf, and east of Andau, Nikelsdorf,[21] D. Jahrndorf, and Kittsee.

6. *With the Czecho-Slovak State:*

From the point above defined northwestwards to the bend of the old frontier of 1867 between Austria and Hungary about 2½ kilometers northeast of Berg, a line to be fixed on the ground, cutting the Kittsee-Pressburg road about 2 kilometers north of Kittsee;

Thence northwards to a point to be selected on the principal channel of navigation of the Danube about 4½ kilometers upstream from the Pressburg bridge, a line to be fixed on the ground following as much as possible the old frontier of 1867 between Austria and Hungary;

Thence westwards to the confluence of the Morava (March) with the Danube, the principal channel of navigation of the Danube;

Thence the course of the Morava upstream, then the course of the Thaya upstream to a point to be selected about 2 kilometers southeast of the intersection of the Rabensburg-Themenau road with the Rabensburg-Lundenburg railway;

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[6] Tóka on the 1:200,000 map. [7] Bónisfalva. [8] Gedöudvar. [9] Németlak. [10] Rábakeresztúr. [11] Zsámand. [12] Németbükkös. [13] Karácsfa. [14] Nagysároslak. [15] Trott kö. [16] Ólmod. [17] Locsmánd. [18] Hidegség. [19] Német-Pereszteg. [20] This locality should be spelled thus on Pl. VI, and not Mexico. [21] Nickelsdorf.

Thence west-northwestwards to a point on the old administrative boundary between Lower Austria and Moravia situated about 400 meters south of the point where this boundary cuts the Nikolsburg-Feldsberg railway, a line to be fixed on the ground passing through points 187 (Dlouhyvrch),[22] 221 (Rosenbergen), 223 (Wolfsberg), 291 (Raistenberg), 249, and 279 (Kallerhaide);

Thence west-northwestwards the above-mentioned administrative boundary;

Thence westwards to a point to be selected about 3 kilometers east of the village of Franzensthal, the old administrative boundary between Lower Austria and Bohemia;

Thence southwards to point 498 (Gelsenberg) about 5 kilometers north-northwest of Gmünd, a line to be fixed on the ground passing east of the Rottenschachen-Zuggers road and through points 537 and 522 (G. Nagel B.);

Thence southwards and then west-northwestwards to a point on the old administrative boundary between Lower Austria and Bohemia situated about 200 meters north of the point where it cuts the Gratzen-Weitra road, a line to be fixed on the ground passing between Zuggers and Breitensee, then through the most southeasterly point of the railway bridge over the Lainsitz leaving to Austria the town of Gmünd and to the Czecho-Slovak State the station and railway works of Gmünd (Wolfshof) and the junction of the Gmünd-Budweis and Gmünd-Wittingau railways, then passing through points 524 (Grundbühel), 577 (north of Hohenberg),[23] and 681 (Lagerberg);

Thence southwestwards the above-mentioned administrative boundary;

Then northwestwards the old administrative boundary between Upper Austria and Bohemia to its point of junction with the frontier of Germany.

7. *With Germany:*

The frontier of August 3, 1914.

Article 49.

The inhabitants of the Klagenfurt area will be called upon to the extent stated below, to indicate by a vote the state to which they wish the territory to belong.

The boundaries of the Klagenfurt area are as follows:

From point 871, about 10 kilometers to the east-northeast of Villach, southwards to a point on the Drave about 2 kilometers above St. Martin, a line running approximately from north to south to be fixed on the ground;

Thence in a northwesterly direction as far as a point about 1 kilometer southeast of the railway bridge on the eastern branch of the bend formed by the Drave about 6 kilometers to the east of Villach, the course of the Drave;

Thence in a southwesterly direction to point 1817 (Malestiger), a line to be fixed on the ground passing through point 666 (Polana) and cutting the railway between Mallestig and Faak;

Thence in an east-southeasterly direction, then northeast to point 1929 (Gushowa),[24] the watershed between the basins of the Drave to the north and the Save to the south;

Thence northeast to point 1054 (Strojna), a line to be fixed on the ground following in a general manner the western boundary of the basin of the Miess, passing through points 1558, 2124, and 1185;

Thence northeast to point 1522 (Hühner Kogel), a line to be fixed on the ground, crossing the Drave to the south of Lavamünd;

Thence westwards to point 842, 1 kilometer west of Kasparstein, a line to be fixed on the ground passing to the north of Lavamünd;

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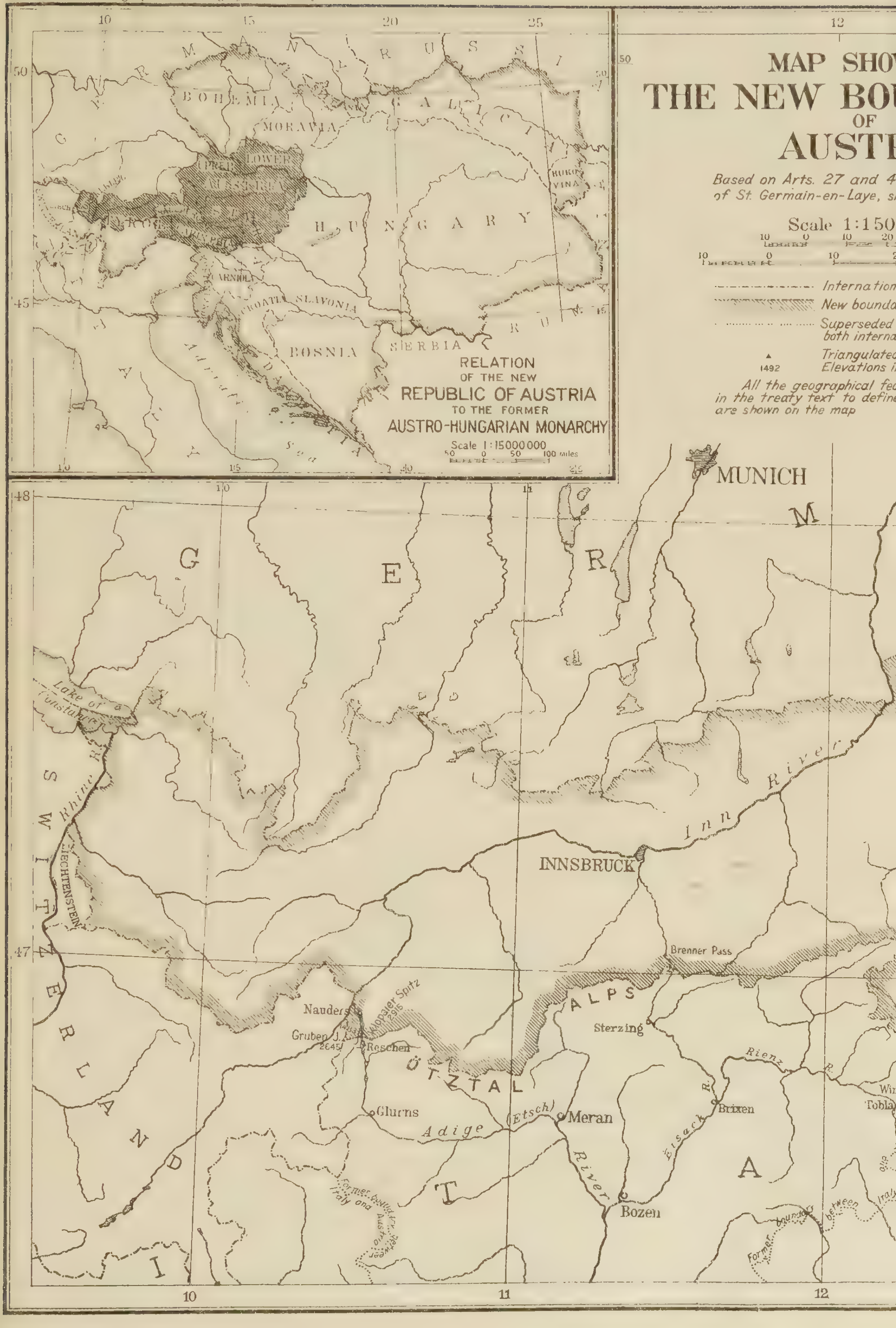
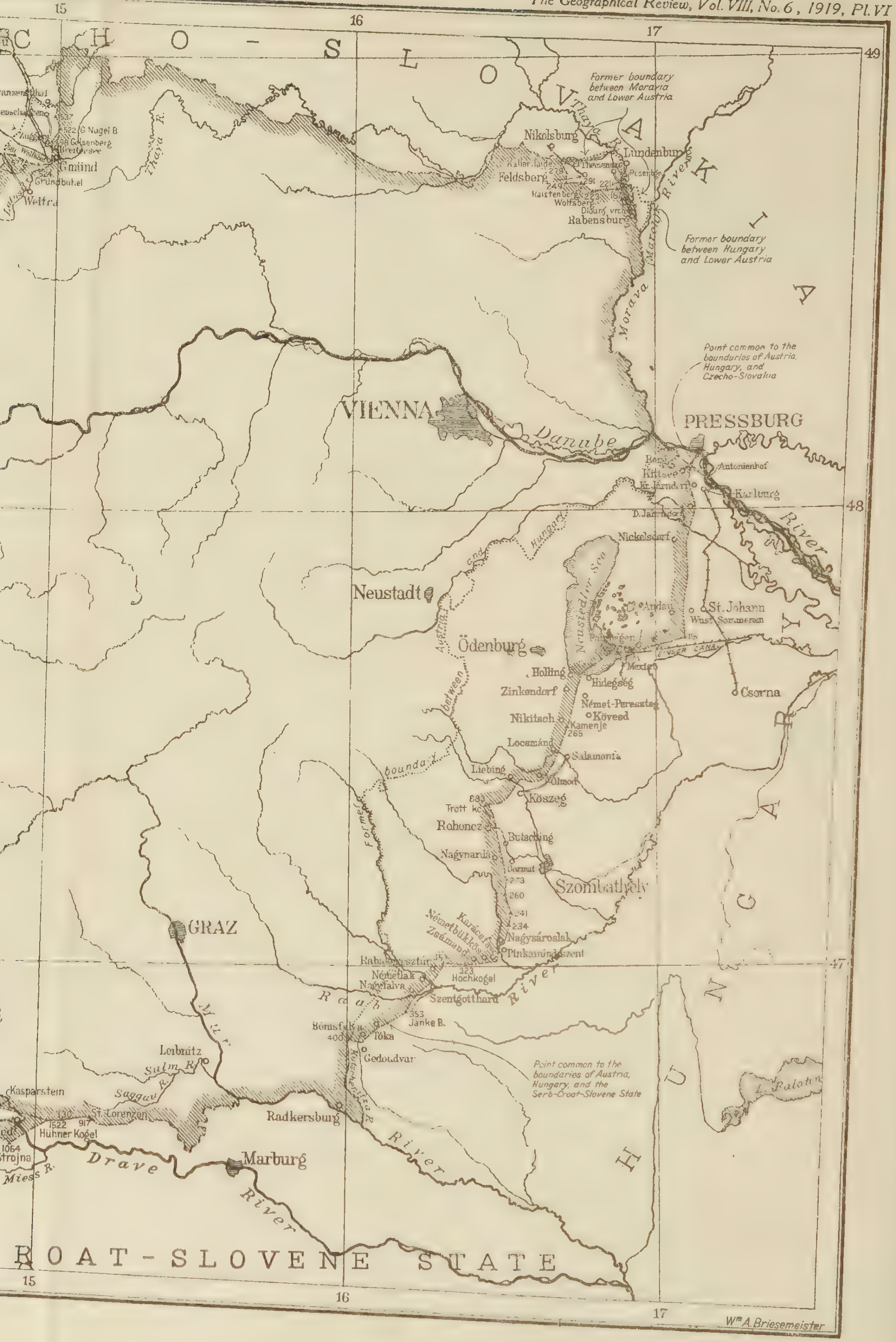
[22] Dlouhý vrch on the 1:200,000 map.

[23] Höhenberg.

[24] Ouschowa on the 1:75,000 and 1:200,000 maps.

The American Geographical Society of New York




15
16
17
49
48
47
C H O - S L O V A K I A
Former boundary between Moravia and Lower Austria
Former boundary between Hungary and Lower Austria
Point common to the boundaries of Austria, Hungary, and Czecho-Slovakia
Point common to the boundaries of Austria, Hungary, and the Serb-Croat-Slovene State
Gmünd
Weitra
Grundbuhel
Nagel B
Gelsenberg
Breitensee
Thaya R.
Nikolsburg
Lundenburg
Feldsberg
Kaltenberg
Wolfsberg
Rabensburg
Thaya
Morava
March River
VIENNA
Danube
PRESSBURG
Berg
Kittsee
Kr. Jàrndorf
Antonienhof
Karlburg
D. Jàrndorf
Nickelsdorf
Neusiedler See
Andau
St. Johann
Wüst Sommerein
Pamhagen
Einser Canal
Mexie
Csorna
Neustadt
Ödenburg
Holling
Hidegség
Zinkendorf
Német-Pereszteg
Köveed
Nikitsch
Kamenje
265
Locsmánd
Salamonfa
Liebing
Olmod
Köszeg
883
Trott kö.
Rohoncz
Butsching
Nagynarda
Dozmat
260
241
234
Szombathely
Nagysároslak
Pinkamindszent
Németbükkös
Karácsfa
Zsámánd
Rabakeresztúr
Németlak
Nagyfalva
323
Hochkogel
Szentgotthard
353
Janke B.
Bonusfalva
400
Tóka
Gedoudvar
Raab River
Raab
Kutschenitza R.
Radkersburg
River
Austria between Hungary and boundary
Former boundary
GRAZ
Mur
Leibnitz
Sulm R.
Saggau R.
Kasparstein
St. Lorenzen
1522
917
Hühner Kogel
1064
Strojna
Miess R.
Drave
Marburg
River
ROAT - SLOVENE STATE
H U N G A R Y
L. Balaton
Wm A. Briesemeister

Thence as far as point 1899 (Speikkogl), the northeastern administrative boundary of the district of Völkermarkt;

Thence in a southwesterly direction and as far as the river Gurk, the northwestern administrative boundary of the district of Völkermarkt;

Thence in a southwesterly direction as far as a point on the administrative boundary to the west of point 1075 (Steinbruch Kogel), a line to be fixed on the ground, passing through point 1076;

Thence in a westerly direction and as far [as] a point to be fixed near point 725, about 10 kilometers northwest of Klagenfurt, the administrative boundary between the districts of St. Veit and Klagenfurt;

Thence as far as point 871, which was the starting point of this description, a line to be fixed on the ground, passing through points 815 (Freudenberg), 1045 (Gallinberg), and 1069 (Taubenbühel).

Article 50.

With a view to the organization of a plebiscite, the Klagenfurt area will be divided into two zones, the first to the south and the second to the north of a transversal line of which the following is a description:

From the point where the western boundary of the area leaves the Drave in a northerly direction as far as the point about 1 kilometer to the east of Rosegg (Saint-Michael), the course of the Drave downstream;

Thence in a northeasterly direction and as far as the western extremity of the Wörther See, south of Velden, a line to be fixed on the ground;

Thence in an easterly direction to the outlet of the Glanfurt from the lake, the median line of that lake;

Thence eastwards to its confluence with the river Glan, the course of the Glanfurt downstream;

Thence eastward to its confluence with the river Gurk, the course of the Glan downstream;

Thence in a northeasterly direction, to the point where the northern boundary of the Klagenfurt area crosses the river Gurk, the course of the Gurk.

The remainder of Article 50 provides, among other things, that a plebiscite is to be held in the first zone within three months of the coming into force of the treaty. If the vote is in favor of Austria, both zones go to Austria. If the vote is in favor of the Serb-Croat-Slovene State, a plebiscite is to be held in the second zone three weeks from the proclamation of the result in the first zone.

Size and Population

Within its new boundaries Austria comprises: including the first plebiscite zone, 30,705 square miles; including both zones, 31,734 square miles; with an approximate population of 6,500,000. These figures for area were obtained by plotting the new boundaries on the scale of 1:1,000,000 on millimeter cross-section paper and determining the number of square millimeters enclosed, with the necessary transformations. For a geographical appraisal of the new state, comparable to South Carolina in size, see the first article in the *Journal of Geography* for January, 1920. The object of this note is merely to present an accurate delineation of the new boundaries, based on the original sources.

THE SUN'S ATMOSPHERE:

A REVIEW OF BIGELOW'S WORK ON THE SUN

By ELLSWORTH HUNTINGTON

Professor Frank H. Bigelow, lately of the U. S. Weather Bureau and now of the Argentine Meteorological Office, has recently published "A Treatise on the Sun's Radiation"[1] which is a continuation of his "A Meteorological Treatise on the Circulation and Radiation in the Atmospheres of the Earth and of the Sun,"[2] published in 1915. Both books are alike in being full of the stiffest kind of mathematics and hence in being not only incomprehensible but unreadable by the average scientist. Both are also alike, however, in being of high importance as pioneer volumes in the complete reconstruction of meteorology and solar physics which is fast acquiring momentum. The reviewer makes no pretense of being able to judge the mathematical merits of Bigelow's last book, or even of having understood a large part of it, for such an understanding is possible only to a few highly trained mathematicians. Nevertheless, he feels safe in making two statements. The first is that future work will reveal many errors. Where so many assumptions are required and so many diverse methods of calculation are available, it is humanly impossible for a pioneer worker to be entirely correct. Critics of far less ability and originality than Professor Bigelow are sure to magnify these errors, overlooking the truth which the reviewer believes to be embodied in his second statement, which follows.

IMPORTANCE OF BIGELOW'S WORK

The second statement is that Professor Bigelow's main conclusions are probably for the most part correct, and even where they are in error they take high scientific rank because of their originality and because of their stimulus to other workers. There are two main reasons why the reviewer, in spite of his inability to follow the intricate mathematical processes, believes that this statement is warranted. The first is that the author has "made good." Twenty or thirty years ago he advanced a number of new ideas which were received in some quarters almost with derision. They dealt with such matters as the shifting of storm tracks in response to solar changes, the relation of storms to magnetic disturbances, and the general relation of atmospheric circulation to solar variations. These ideas made many people regard Bigelow as "visionary," but time has vindicated him. All his main ideas, with such modifications as new work, of course, must bring, are now accepted by a large and growing body of the leading students of meteorology. In line with this progress the U. S. Weather Bureau is now experimenting with the use of solar observations in order to help in predicting the weather. The Bureau will probably have only indifferent success until the importance of electrical as well as thermal conditions is recognized, but the fact that the importance of solar variations is thus admitted is a tribute both to Bigelow and to the progressiveness of the Weather Bureau.

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[1] F. H. Bigelow: A Treatise on the Sun's Radiation and Other Solar Phenomena, in Continuation of the Meteorological Treatise on Atmospheric Circulation and Radiation, 1915. ix and 385 pp.; diagrs., index. John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London, 1918. $5.00. 9 x 6.

[2] Reviewed in the *Geogr. Rev.*, Vol. 2, 1916, pp. 323-324.

The second reason for thinking that Bigelow is on the right track is that the results give unity and scientific coherence to a subject which has hitherto been extremely vague. Moreover, by means of his methods, observations which had previously seemed discrepant now fall into harmony.

The Constitution of the Sun: The Isothermal Layer of Its Atmosphere

The book under review treats the sun's atmosphere exactly as the earth's atmosphere is treated in a previous book. We must think of the sun, the author tells us, as a central mass of semi-solid gases under inconceivably great pressure and at temperatures which can only be guessed. From this central mass outward there is a gradual decline in pressure and temperature according to the well-known laws of adiabatic cooling, which have been thoroughly worked out in the earth's atmosphere. Finally, on the sun, just as on the earth, an isothermal layer is reached where for an appreciable radial distance there is no change of temperature. In this layer several important alterations take place. First, many or perhaps all of the elements are transformed from the atomic to the molecular condition. The heat given out by this transformation is apparently the reason why the solar atmosphere does not change in temperature. Again, the heavier gases, such as those of the metallic elements, here reach their highest level. An occasional jet of iron or mercury or some other heavy element may be carried up in a vortical whirl, but only rarely and to a short distance, for its weight causes it to fall back at once. The presence of the isothermal layer and the fact that the heavy elements rise no higher explain a condition which has puzzled a great many students, namely the sharpness of the sun's rim. According to the old ideas the gaseous condition of the sun ought to give a hazy rim corresponding to a gradual decrease in the density of the gases. Bigelow's hypothesis gives an edge which would appear sharp from the earth. Outside of the isothermal layer the sun's atmosphere cools more rapidly than below, for the process becomes non-adiabatic.

Bearing of Extreme Complexity of Solar Phenomena on Our Knowledge of the Relationship Between the Sun and the Earth

The conception of an isothermal layer leads to an explanation of sun spots, faculae, flocculi, and prominences. Each is due to some special method by which the gases below the isothermal layer break through and are shot outward and then grow cool and fall back. For the ordinary worker the great lesson of this part of the book is the extreme complexity of the solar phenomena and the probability that a vast number of changes occur in such a way that they cannot be detected from the earth except by the use of new methods. The most hopeful method for such detection lies in further study of electrical, magnetic, and perhaps radioactive conditions, but even these may not reveal all the sun's activities. Hence if a connection between sun spots and weather is established, as has been done again and again, the chances are that the real connection is far greater than appears on the face of the returns, for an unknown number of other unmeasured solar conditions are also changing. The true relationship between the sun and the earth can be determined only by combining all of these solar phenomena on the one hand and all the changes in the earth's atmosphere on the other.

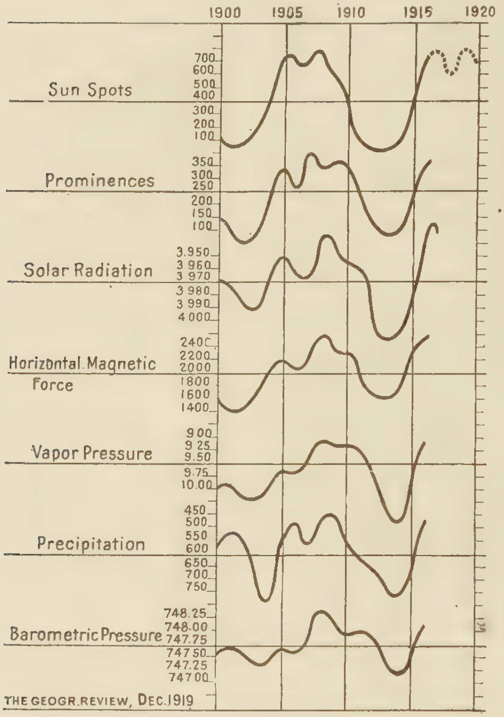

FIG. 1—Diagram showing the synchronism of the solar and terrestrial variations (reproduced from Fig. 27 of F. H. Bigelow's "A Treatise on the Sun's Radiation," 1918).

NEED OF CO-ORDINATION OF SOLAR AND TERRESTRIAL DATA

In this connection Bigelow points out[3] that the "growth of research is unduly retarded" because the solar and terrestrial data are

> not sufficiently homogeneous to bring out clearly the small true solar residuals; the observations are made in the interests of short-range forecasts to the entire neglect of the long-range forecasts of solar physics; the several branches of the subject are so scattered as to be unmanageable—the solar physics, the bolometric spectra, the magnetic field, the electric ionization, the climatic meteorology, all being separated among different administrative offices; the published reports from these different sources are so retarded that they are useless in any study of current forecasts whatsoever; there exists no systematic machinery for handling this kind of world-wide material.
>
> It is inevitable that several international institutes shall be established—*at least four,* one in the United States, one in Argentina, one in Europe or Asia, and one in Africa or

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[3] P. 237.

> Australia—which shall co-operate upon a fixed general plan, utilize selected data, and treat the subject from the world-wide point of view. The long-range system [of forecasting which Bigelow believes to be now practicable] will begin with annual forecasts, already easy in Argentina, and advance to details [as to months, weeks, and days] in accordance with the progress in solar physics.

Whatever his views may be, no student of meteorology, climatology, magnetism, or solar physics, will question the value of such institutes. From the purely financial standpoint they would in a few decades prove great money-makers, not for themselves, but for mankind.

Agreement Between Solar and Terrestrial Phenomena

Turning now to the point which gives chief interest to all solar studies, namely their relation to the earth, Bigelow does not take this up so fully as might be wished. In fact the greatest lack of the book is actual facts as opposed to theoretical deductions. On page 234, however, the author gives a set of tables which are so valuable that they are here reproduced, together with the corresponding diagram. A marked agreement between solar and terrestrial phenomena is evident both in the 11-year cycle and in a shorter cycle which Bigelow calls 3.75 years.

Summary of the Solar and Terrestrial Observations Showing a Synchronism in the Variations in the 11-Year and the 3.75-Year Periods

Year of Observation	Sun Spots	Prominences	Radiations	Horizontal Magnetic Amplitudes	Precipitation	Temperature	Vapor Pressure	Barometric Pressure
1900	114	128	.....	1,589	855	17.81	10.50	749.28
1901	33	88	.....	1,374	573	17.87	9.88	49.43
1902	60	47	.....	1,464	716	17.68	10.35	48.59
1903	293	118	3.989	1,926	775	17.49	10.52	49.22
1904	503	291	3.979	1,787	914	17.17	10.30	49.12
1905	762	302	3.955	2,194	719	16.75	10.22	49.24
1906	646	261	3.975	2,015	613	17.55	10.07	49.33
1907	745	427	3.971	2,299	648	16.83	9.86	49.52
1908	583	346	3.940	2,584	615	17.11	9.55	49.97
1909	527	365	3.960	2,334	566	17.08	9.34	49.90
1910	223	259	3.952	2,354	651	16.96	9.31	49.59
1911	68	163	3.960	1,923	751	16.40	9.26	49.75
1912	43	126	3.978	1,520	811	17.51	10.09	49.72
1913	17	135	4.003	1,564	704	18.19	10.53	49.44
1914	115	198	4.002	1,672	928	17.28	10.78	48.77
1915	350	250	3.990	2,635	773	17.32	10.06	48.92
1916	540	400	3.920	2,676	486	17.65	8.87	49.00

Sun spots.—Data from Wolfer's frequency numbers, *Meteorol. Zeitschr.*, May, 1902; May, 1915.

Prominences.—Data from Ricco's Distribuzione delle protuberanze, *Memorie Soc. degli Spettroscopisti Italiani*, March, 1914.

Radiation.—Bigelow's reduction of the pyrheliometer data.

Horizontal Magnetic Amplitudes.—Bigelow's compilation from European observatories and Pilar, Argentina.

Precipitation, Temperature, Vapor Pressure, and Barometric Pressure.—From the Argentine stations Tucumán, Andalgala, Goya, Concordia, Córdoba, Pilar, Buenos Aires, Victorica, Bahia Blanca, Patagones.

Value of the Solar Constant

One other point deserves notice. Bigelow disagrees radically with Abbot as to the value of the solar constant. He holds that in his calculations Abbot has omitted important factors, such as potential and electromagnetic energy, which ought to be considered as well as kinetic energy. The question is so purely mathematical that the reviewer cannot judge its merits; but Bigelow's results seem to be the more consistent. He concludes that the temperature at the sun's isothermal layer is 7,655°C. This gives a solar constant of 5.85 gram calories per centimeter per minute, but in passing through the rest of the sun's atmosphere this is diminished to 3.98. Bigelow seems to state that the difference in brightness between the sun's center and edge is equal to the diminution which the sun's energy suffers in passing out from the sun into space, that is $5.85-3.98=1.87$; but it is impossible to tell how he arrives at this conclusion. The value 3.98 is held to be the amount of energy received at the upper limit of the earth's atmosphere, a value which Abbot puts at only 1.93, or half as much. The difference between these two views is of great practical importance because the greater the energy received from the sun, the greater the intensity of changes, and the greater the likelihood that the breaking forth of the hot lower solar gases through the isothermal layer may cause pronounced climatic fluctuations upon the earth.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Distribution of Title Page, Contents, and Index of Volume VIII of the "Geographical Review." The title page, table of contents, and index for the current volume of the *Geographical Review* (Vol. VIII, July-December, 1919) will be issued separately and not with the present number. Copies will be sent to all institutions exchanging publications with the Society and, on request, to others who desire to receive them.

NORTH AMERICA

The Alleged Journey of James White Through the Grand Canyon in 1867. Mr. Robert Brewster Stanton, of New Canaan, Conn., made a railroad survey through the canyons of the Colorado in 1889 and 1890, when he followed the main river from Green River Station, Wyo., to the Gulf of California; he later spent several years on the river and knows its turbulent waters intimately. He has lately prepared a valuable discussion of "The Alleged Journey and the Real Journey of James White on the Colorado River in 1867," which appeared in the September, 1919, number of *The Trail*, a monthly publication issued at Denver as the official organ of the Sons of Colorado and other local societies. In spite of the pamphlet by Thomas F. Dawson printed by the United States Senate in 1917 (The Grand Canyon: An Article Giving the Credit of First Traversing the Grand Canyon of the Colorado to James White. . . . , *65th Congr., 1st Sess., Senate Doc. No. 42,* 67 pp., Washington, D. C., 1917), in which it is maintained that White actually descended the river on a raft for 550 miles, including the Grand Canyon stretch, and in spite of a further statement by Dawson to similar effect in *The Trail* for February, 1919, Stanton not only shows that these statements are erroneous but explains in the clearest manner how the published errors entered the story. He tells of a personal interview with White in 1907 and of his estimate of him as a perfectly honest and truthful but uneducated man; of the way in which White was led, by a remark made to him by Dr. C. C. Parry (see below), whom he met at Callville, where his raft journey ended, to believe that he had descended the river for 550 miles and therefore, as Dr. Parry told him, from above the junction of the Green and the Grand; of White's own perfectly definite and consistent statements regarding the height and color of the canyon walls and regarding the side of the canyon from which tributary rivers enter it; and of the clear evidence afforded by these statements that the river which White had called the Little Colorado on the authority of Dr. Parry and which enters the Colorado from the left (south), upstream from the Grand Canyon, was really the Virgin, which enters the Colorado from the right (north), as White himself testified emphatically, and below the Grand Canyon. It was therefore in the neighborhood of the Virgin River confluence, west of the Grand Wash Cliffs and below the Grand Canyon, that White's raft journey began; and the canyons through which he passed between there and Callville, where he left the river, are those by which certain Basin Ranges are traversed.

To those who are interested in tracing the development of the claim that James White in 1867—and not Major Powell in his famous trip of 1869—was the first navigator of the Grand Canyon stretch of the Colorado River, the following statements may be helpful. The first account of White's journey is contained in a report by Dr. C. C. Parry, assistant geologist of the Union Pacific Railway (also known as the Kansas Pacific Railway) survey of 1867-68, dated January 6, 1868, which was read on February 17, 1868, before the Academy of Science of St. Louis and published in its *Transactions*, Vol. 2, 1861-68, pp. 499-503, in advance of its publication in the official report made to the company by General William J. Palmer, Director of Surveys, entitled "Report of Surveys Across the Continent," 1868. (Dr. Parry had served as botanist and geologist on the Mexican Boundary Surveys of 1849 and 1854-55.) Possibly the best known version of White's journey is that which constitutes Chapter 13 of Part III of "New Tracks in North America" (2 vols., London, 1869) by William A. Bell. This account was prepared from Dr. Parry's notes by Major A. R. Calhoun, who accompanied the Kansas Pacific survey expedition as correspondent of the *Philadelphia Press.* Dr. Bell was physician to the expedition. Major Calhoun's account was, it seems, also published in Philadelphia at about the same time in a small book entitled "Wonderful Adventures." A newspaper version of White's journey appeared in the *Rocky Mountain*

Herald for January 8, 1869, and the *Rocky Mountain News* for February 17, 18, and 19, 1869. Except for the photographic reproduction in *Outing Magazine* for April, 1907 (pp. 48-49), of a letter about his journey that White wrote on September 26, 1867, to a brother then living in Wisconsin, these seem to have been the main sources of information until *Senate Document No. 42* appeared. This contains (pp. 39-43) an account by White himself written in 1916, in his seventy-ninth year. The leading criticism of White's story prior to the present discussion of the question appears in F. S. Dellenbaugh's ''The Romance of the Colorado River'' (New York, 1906, pp. 174-183). In his second book on the Colorado, ''A Canyon Voyage'' (New York, 1908, pp. v and 2), Mr. Dellenbaugh, who was a member of Powell's second (1871-72) expedition, briefly repeats his doubt as to White's trip, a doubt which had likewise been expressed by Mr. Stanton in 1892 in his ''Availability of the Cañons of the Colorado River of the West for Railway Purposes'' *(Trans. Amer. Soc. of Civil Engineers,* Vol. 26, 1892, pp. 283-362) and by George Wharton James in his ''In and Around the Grand Canyon'' (Boston, 1900, pp. 17-18).

Mr. Stanton's article in the September, 1919, number of *The Trail* is an abstract from a manuscript which treats in much detail ''The Exploration, Navigation, and Survey of the Colorado River of the West'' from 1540 to the present time. It is to be hoped that this manuscript may be published as a valuable contribution to American history.

Among later boat journeys down the Colorado mention may be made of one conducted by Julius F. Stone, of Columbus, Ohio, who started from Green River Station, Wyo., on September 12, 1909, with four companions, one of whom was compelled for business reasons to withdraw near the head of Glen Canyon. The others completed the trip through the Grand Canyon and arrived at Needles, Cal., on November 19. Mr. Stone was exceptionally successful in photographing the canyon; his albums contain an unrivaled series of views. As far as is known, no account of this journey has hitherto been published. W. M. Davis

SOUTH AMERICA

Geography and the Colombian Coffee Market. How geographical factors often influence present-day trade in staple commodities was excellently illustrated by a recent situation in the coffee market in Colombia. It will be remembered that coffee is the most valuable export product of that South American republic, forming about 50 per cent of the trade to foreign countries.

During June, 1919, very unusual quotations prevailed in the market there. The prices offered for immediate delivery rose to unheard-of points, while at the same time the prices for future delivery remained quite normal, even though speculators attempted to bring about a corresponding rise and rumors of an impending shortage were circulated in North American markets. The reason for the peculiar situation was attributed to the very small quantity of ''spot'' coffee offered for sale. This in turn resulted from a serious lack of rainfall during the preceding months of April and May, when the highlands and the upper valleys of the Colombian Andes usually receive a great proportion of their yearly precipitation. It was not, however, because of a crop failure that prices soared, else ''futures'' too would have shared in the fluctuation. The explanation lay rather in the effect of a light rainfall upon the volume of water carried by the streams upon which transportation depended.

The mountainous character of Colombia has hindered railway development and so compelled it to depend largely upon river navigation for the movement of its products. The streams, in their upper courses mere mountain torrents, are navigable, in many cases, only after heavy rains on the uplands whence they spring. Even traffic on the great Magdalena (''Colombia's life line,'' as it has been called) is subject to serious interruptions in seasons of light rain, at times a whole month elapsing without the passing of a single steamer (see Hamilton W. Wright: Transportation on the Magdalena River, Colombia, *Scientific American Suppl.*, Feb. 8, 1919, pp. 88-89).

Most of the coffee plantations are located upon the mountain slopes that flank the Magdalena and its tributaries, the Cauca, the Lebriga, and the Sogamoso. The lack of water in these streams during the past summer, when precipitation had been scanty, so reduced their volume that much of the season's coffee crop, harvested in March and April, was held at interior points until the rivers rose sufficiently to float it, thus producing a crisis in the market for ''spot'' coffee, though the trade in ''futures'' remained unaffected.

The Climate of São Paulo and Ceará, Brazil. Mr. R. C. Mossman, who was for some years connected with the Argentine Meteorological Service, is at present devoting attention to the climatology of various portions of South America. Hitherto by far the greater part of all available published data for South America have covered varying periods of time and have not been reduced to a homogeneous system. Hence these observations have not been directly comparable and have lacked the accuracy which is an absolute essential in all good climatological work. In two recent communications (*Quart. Journ. Royal Meteorol. Soc.*, Jan., 1919), Mr. Mossman gives the results of compilations which he has completed for the state of São Paulo and for the city of Fortaleza in the state of Ceará, Brazil. The chief interest of São Paulo centers in its coffee industry, but the region is also becoming more and more a cattle country. Mr. Mossman has now reduced the temperatures and rainfalls of São Paulo, as published, to a homogeneous system. The data were extracted from the ''Dados Climatologicos'' of the Serviço Meteorologico de São Paulo, issued since 1887, the last volume published dealing with the year ending November, 1912. These bulletins give an abundance of climatic information with a detail ''such as is available for no other portion of South America.'' Mr. Mossman's summary includes all the essential facts.

The special interest of the state of Ceará lies in the fact that this region is periodically visited by severe droughts, and the object of the present study is to summarize the results regarding rainfall obtained from 1849 to 1915, the ultimate end in view being an investigation which it is hoped may lead to a clue concerning the ''precise mechanism associated with these droughts.'' The rainfall data are given in great detail, in convenient and easily accessible form, and will prove of distinct value to all those who are interested in the economic climatology of Brazil.

R. DeC. Ward

EUROPE

Peace Treaty Texts and Maps. Since the publication of the article on the new boundaries of Germany in the May number, the *Geographical Review* has presented no further information on the territorial changes resulting from the settlements of the war. The reason for this is that for none of the countries affected is the complete circuit of its boundaries defined. For some all parts of their new boundaries are accounted for, some parts being fixed, while others are dependent on the result of plebiscites still to be held; of other countries large parts of their boundaries are not even defined. Austria is for the moment the country most completely outlined; its boundaries will be complete when the relatively small part involved in the Klagenfurt area shall be decided by plebiscite. The boundaries of this country therefore lending themselves to precise definition and representation, they are given in the present number of the *Review* (pp. 345-349, with Pl. V). As soon as feasible, the boundaries of the other countries affected will likewise be represented in the *Review;* in the meantime this note is to serve to bring the record up to date.

The description and map of the new boundaries of Germany in the May number were based on a summary of the preliminary ''conditions of peace'' presented to the Germans on May 7, 1919. Before the treaty in its final form was signed on June 28 several substantial modifications had been made in the territorial clauses. According to Article 109 the southernmost of the three Slesvig plebiscite zones shown in the upper left inset of the map in the May *Review* was dropped, i. e. this zone is to remain German territory and plebiscites are to be held to determine the sovereignty of the two other zones only, in the northern as a unit within 31 days, in the southern by communes within 66 days of the coming into force of the treaty (i. e. January 10, 1920). The new eastern boundary of Germany was extensively altered in detail in the final treaty (Article 27, Section 7), but the main change was the concession to the Germans that the sovereignty of Upper Silesia be decided by plebiscite (not sooner than six months nor later than eighteen months after the establishment of an international commission in the area, to take place within fifteen days of the coming into force of the treaty; Sections 4 and 1 of Annex to Article 88).

The original source for the definition of the new boundaries is, of course, the official treaty text. In view of the relative inaccessibility of official copies, a few words of bibliographical characterization may not be amiss. The official treaty text is a paper-bound volume of xv+428+4 pages, 13 by 9 inches in size, with text in French and English on opposite pages, entitled ''Treaty of Peace Between the Allied and Associated Powers and Germany and Protocol Signed at Versailles, June 28, 1919.'' It is accompanied by four maps, one a general map of Germany showing the new boundaries, 1:1,000,000, and three detailed maps showing respectively the Territory of the Saar, 1:100,000, the Danzig area, 1:100,000, and the Slesvig plebiscite areas, 1:200,000. The map of Germany is a transfer from the well-known map of Europe prepared by the Royal Geographical Society under the direction of the Geographical Section of the General Staff.

The new boundaries are overprinted in red, distinction being made between the sections which do and which do not require to be delineated on the ground; in addition all the towns and other geographical features referred to in the text are shown in red. The map bears the imprint of the Service Géographique de l'Armée and is dated June 23, 1919. The three detailed maps show the respective boundaries in color overprinted on a photolithographic reproduction in gray of the relevant sheets of the standard topographic map of Germany in 1:100,000. The American edition of the treaty is entitled "Treaty of Peace with Germany" (194 pp.; Washington, D. C., 1919) and forms *66th Congr., 1st Sess., Senate Doc. No. 49;* it lacks the maps. The British edition is issued as a blue book designated *Treaty Series No. 4 (1919)* and contains the maps.

As to the other treaties disposed of since then, the following may be said:

The second treaty to be concluded was that with Austria, signed at Saint-Germain-en-Laye, September 10, 1919. The resulting boundaries of the new state are fully dealt with in the article in the present number, in which, as footnote 1, the original sources are referred to.

On November 27, 1919, at Neuilly, was signed the treaty with Bulgaria. The full treaty text is not yet available but from the summaries published in the press it would appear that the territory of Bulgaria is, in the main, left intact. On the western frontier several "rectifications" are made in favor of the Serb-Croat-Slovene State, mainly in the cession of the upper Strumitsa Valley, which had formed too close an avenue of approach to the vital Morava-Vardar artery, and in the Tsaribrod and Bosiligrad districts west of Sofia. In the south Bulgaria loses the frontage on the Aegean she gained at the end of the Balkan wars, an economic outlet to that sea being guaranteed to her, however.

The latest treaty to be taken up is that with Hungary. The conditions of peace were handed to the Hungarian delegation at Paris on January 15, 1920. The press despatches announcing this fact contain practically no reference to the territorial provisions of the treaty. According to a seemingly authentic small-scale map in the January 17, 1920, issue of *Amerikai Magyar Népszava,* a Hungarian newspaper published in New York, the boundaries of the new state seem broadly to coincide with the ethnographic limits of the compact mass of Magyars, with a tendency to lie within these limits.

With the boundaries of Hungary determined, the following countries undergoing territorial changes as a result of the war have their limits defined, completely or in part: Belgium (through the addition of Moresnet and the *Kreise* of Eupen and Malmédy), France (through the addition of Alsace-Lorraine), Italy (boundary towards Yugo-Slavia still undetermined), Yugo-Slavia (undetermined towards Italy, Rumania, and Albania), Greece (undetermined towards Turkey and Albania), Bulgaria, Rumania (undetermined towards Yugo-Slavia, Russia, and Poland), Hungary, Austria, Czechoslovakia (undetermined towards Poland and Rumania), Poland (undetermined towards Rumania and Russia), Germany, Denmark (dependent on results of plebiscite), Finland (extent same as former Grand Duchy, with the province of Karelia and the district of Pechenga on the Arctic coast still in dispute). Among prospective countries in Europe no part of whose boundaries are definite as yet are Albania and the three Baltic states Lithuania, Latvia, and Esthonia. In Asia the countries which may be formed within the former territory of the Turkish Empire are also still without definite boundaries. These countries may possibly consist of Armenia, Syria, Palestine, Mesopotamia, and the Hedjaz. A map of Europe on the scale of 1:20,000,000 has been published by the American Geographical Society which shows the boundaries of the new states. While many of these boundaries, as stated above, are not yet defined, the map shows them in the main as recommended by the territorial experts to the Supreme Council of the peace conference, and they therefore have a certain probability. A copy of the map will be sent free on request to any Fellow of the Society, to others at 25 cents a copy.

A Frontier Custom in the Pyrenees. It is customary to quote the Pyrenees as the approximately ideal natural boundary, and it does in fact constitute the most stable political boundary of continental Europe. The antiquity of the boundary function of the Pyrenees is seen in an interesting frontier episode that has taken place at the Pass of Hernaz from times so remote that its origin is lost (Germán Baraibar y Usandizaga: En el Pirineo navarro: El tributo de las tres vacas, *Rev. de Geogr. Colon. y Mercantil,* May 1919, Real Soc. Geogr. de Madrid; see also Elisée Reclus: L'homme et la terre, Vol. 1, Paris, 1905, p. 184, and Ardouin-Dumazet: Voyage en France, Vol. 41, pp. 157-158).

Annually on July 13 the population of the French valley of Barétous (Basses-Pyrénées) pay a tribute of three cows to their neighbors of the Spanish valley of Roncal (Navarre). Functionaries, attended by villagers and pastors, meet at the boundary stone of San Martín. After exchange of salutations the mayor from Roncal challenges his French vis-à-vis: ''Come you disposed to pay the perpetual tribute of the three cows, as in the past?'' The mayor of the French valley replies in the affirmative, the challenge being repeated and answered three times. The French mayor approaches the boundary stone, laying a hand upon it; a Spaniard places his on top and so on successively. The Spanish mayor completing the pile pronounces three times the phrase ''Pax avant!'' to which the French make the like response. With this the three cows are brought forward and, after approval by the Spanish veterinary, are accepted. Following, four guards, two French, two Spanish, are appointed to inspect the common pastures, and French and Spanish representatives proceed to hold a tribunal for the adjudication of claims and grievances. The ceremony concludes with a feast to which both parties contribute and which, with the performance of local songs and dances, testifies a happy spirit of fraternity.

Old customs linger among a conservative pastoral people, and there does not appear to be any immediate prospect of this particular custom falling in abeyance. It is said that Napoleon III tried to suppress the ceremony as being humiliating to France, but he met with vehement protests on the part of the Barétouese. Even during the recent war, in spite of the restrictions regulating the movement of cattle in the frontier zone of the Pyrenees, the ceremony continued to be held.

PHYSICAL GEOGRAPHY

Are There Persistent Irregularities in the Annual March of Temperature? There is a very widespread popular belief in the recurrence, at about the same time from year to year, of longer or shorter periods of unseasonable heat or cold. Among these ''spells'' perhaps the ones most commonly referred to are the ''January thaw''; a cold period in May, known variously as *saints de glace, Eisheiligen,* or *gestrenge Herren;* and the Indian Summer. Professor Charles F. Marvin, Chief of the Weather Bureau has recently investigated this question (*Monthly Weather Rev.,* Vol. 47, 1919, pp. 544-555) by making a careful study of the temperature records for several long-period stations in the northeastern United States, supplemented by 45-year records from Weather Bureau stations scattered over the country. The conclusion reached is that the annual record of daily mean temperatures is a smooth curve, without secondary maxima and minima, or of perceptible points of inflection. Such marked irregularities as are described by the terms ''January thaw'' or ''May freeze'' neither persist nor do they have a real existence. In cases where these or similar irregularities persist in the means, they are nothing but the effect of a single occurrence or of a few accidentally recurrent unusual or extreme events near or at the time in question.

Those who are interested in this subject will find a useful annotated bibliography, by Professor C. F. Talman, in the same number of the *Monthly Weather Review.*

R. DeC. Ward

GEOGRAPHICAL NEWS

Obituary

Walter G. Davis, director of the Argentine Meteorological Service, died on April 30 at his old homestead in Danville, Vt. As a young man Mr. Davis went to Argentina as assistant to Dr. B. A. Gould, who established the Argentine Meteorological Service in 1872. In 1885 Mr. Davis succeeded Dr. Gould as director, continuing in that position until his retirement in 1915. Under Mr. Davis' able leadership the organization became one of the foremost government meteorological services. In 1904 the weather station at Laurie Island in the South Orkneys (60° 43′ S.) which had been established by the Scottish Antarctic Expedition, was acquired, whereby the range of observation of the Argentine service was made to embrace the whole gamut of climatic conditions from sub-tropical to sub-antarctic.

Personal

Mr. Herbert L. Bridgman gave a lecture on ''Bulgaria Today and Tomorrow'' on November 17 and December 2 in the system of public lectures given under the auspices of the Board of Education of the City of New York.

Professor Henry E. Crampton of the American Museum of Natural History spoke on ''Tahiti and the South Seas'' before the New York Academy of Sciences on December 15.

Dr. Douglas W. Johnson, professor of physiography at Columbia University, who, as major in the army, served as chief of the Division of Boundary Geography and member of several territorial commissions at the peace conference, addressed the Geographical Society of Philadelphia on November 5 on ''Geographical Studies on the Western, Italian, and Balkan Fronts'' and the New York Academy of Sciences on December 15 on ''A Geographer at the Front and at the Peace Conference.'' Professor Johnson has recently published an important volume on ''Shore Processes and Shore Line Development,'' soon to be reviewed in these pages.

Professor A. K. Lobeck of the University of Wisconsin gave a lecture on important geographical phases of the war in the ''Overseas Lectures,'' a series of public addresses given during the academic year 1919-20 by members of the university's faculty who were actively engaged in war work. Professor Lobeck was associated with the work of the American Mission at the peace conference.

Dr. S. C. Schmucker of the West Chester (Pa.) Normal School gave a lecture on ''The Races of Men'' on November 18 before the Brooklyn Institute of Arts and Sciences, in a series of six lectures entitled ''Man, Past, Present, and Future.''

Mr. Louis R. Sullivan, assistant curator in the department of anthropology at the American Museum of Natural History, read a paper before the American Ethnological Society on November 24 on ''Notes on the Negrito Problem.''

Mr. E. H. Wilson, assistant director of the Arnold Arboretum, read a paper on ''Korea and Its Vegetation'' before the Horticultural Society of New York on December 17.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see ''Explanatory Note'' in Vol. II, pp. 77-81

NORTH AMERICA

UNITED STATES

General

MACGILL, C. E., AND A STAFF OF COLLABORATORS. **History of transportation in the United States before 1860.** Prepared under the direction of B. H. Meyer. xi and 678 pp.; maps, bibliogr., index. *Carnegie Inst. Publ. No. 215 C.* Washington, D. C., 1917. $6.00.

This bulky volume is the third contribution to American economic history by the Department of Economics and Sociology of the Carnegie Institution of Washington. As a basis for this comprehensive work special studies, of which a list is included in the preface, were made by a number of collaborators for a period of about ten years. Some of these studies already have been published, while others are still in manuscript in the hands of the Carnegie Institution. The task of Miss MacGill was to weave all of the various basic studies into a whole, filling in the gaps here and there, as found necessary, by her individual research. The present volume in conjunction with the various basic studies, when all are published, will constitute a fairly complete history of transportation in the United States from the earliest times down to the period of the Civil War.

The book contains seventeen chapters, the last seven of which, filling approximately one half of the volume, are concerned primarily with a discussion of the development of railways. Both the evolutionary and the sectional viewpoints of the growth of the country's transportation systems are kept in mind, so that the earlier chapters treat of early trails, roads, and natural waterways; tolls and transportation charges on early roads and canals; traffic by rivers; trails and roads in the trans-Appalachian region; early land routes in Ohio; waterways in New England; canals and water routes in New York; canals and waterways in Pennsylvania; roads, canals, and waterways in the South; transportation in the Middle West before the railroad era; and plank roads.

The reader of this volume will probably be somewhat disappointed that, at times, a great many details have been included which are of little more than local interest and that the broader general aspects of transportation development have not been more prominently set forth. As remarked by Dr. Meyer, however, the volume ''must be viewed as a contribution rather than as a completed study. It seemed much better to utilize as far as possible all of the material which the various collaborators had brought together than to restrict the volume to only such material as would be required in producing a thoroughly systematic, unified, and closely knit book.'' From this point of view Miss MacGill has, on the whole, done an excellent piece of work. The material has been well marshaled, the underlying influences have been placed in the foreground, and prominence has been given to many of the relatively important questions in transportation development.

To those interested in the influence of geographical factors in history it is gratifying to note that certain geographical factors have not been overlooked as having played a prominent part in the development of the various means of transportation. For example, the first paragraph of the first chapter emphasizes the importance of the physical environment by discussing the Appalachian barrier as follows: ''The physiography of that part of the United States which was in process of settlement in the country's early decades was an important factor in determining the geographical distribution of the increasing population. The first settlements had been made in the narrow strip of land lying between the Appalachian Mountains and the Atlantic Ocean. In the earlier periods these settlements were necessarily isolated from each other, and they were compelled by the mountain wall to expand within the coastal region rather than into the interior. A few trails led into the back country, but almost throughout its entire length the mountain barrier was so difficult to overcome that when small settlements were finally established across the Alleghenies any sort of communication with the older colonies was infrequent and irregular. The development of these trans-Appalachian settlements was conditioned upon the development of ways and means of transportation. They needed the markets and the products of the East for the development of any economy except one of an essentially primitive and simple character. From 1750 to 1800, however, their isolation was scarcely broken, and their interests seem to have been local, or at least to have been little regarded by the more populous communities of the East. The early history of transportation, in its national aspects, is largely occupied with an account of efforts, originating sometimes in the East and sometimes in the West, to break through this mountain barrier and establish regular routes of travel connecting the Ohio and Mississippi Valleys with the Atlantic seaboard'' (p. 3).

In various other connections the importance of geographical factors is emphasized, as, for example, in discussing the development of canals and water routes in New York state and in Pennsylvania, and in considering the development of roads, canals, waterways, and railways in the South. With reference to the latter it is stated: ''As it came to be developed in the South at large, the transportation system was a composite of land and water ways, supplementing one another with more or less efficiency for a common end. There was, first, the ocean highway, with reference to which it may be noted that the resort to ocean steamships after about 1820 freed the traffic from dependence upon currents of wind and water and enabled mariners to use the shortest transatlantic route, thereby building up the Northern ports at the expense of those of the South. Closely akin was the navigation of rivers and sounds, and so-called rivers, such as the Potomac and the James in their lower courses, and the bayous of Louisiana, in which there was an appreciable current. . . . Even in the Piedmont country the rivers could be used in flood season to transport small boats with light cargoes, but could hardly be used at all for the upward journey. The introduction of steamboats provided means for upward navigation as far as the fall-line, but they affected the river problem within the Piedmont very little'' (p. 415).

The book contains a full classified bibliography of forty pages. There are maps showing the navigable rivers of the United States, the canals, and the railroads in operation in 1840, 1850, and 1860. AVARD L. BISHOP

GILBERT, C. G., AND J. E. POGUE. **The energy resources of the United States: A field for reconstruction.** x and 165 pp.; maps, diagrs., ills. *U. S. Natl. Museum Bull. 102,* Vol. 1. Smithsonian Inst., Washington, D. C., 1919.

MEINZER, O. E. **Bibliography and index of the publications of the United States Geological Survey relating to ground water.** 169 pp.; map. *U. S. Geol. Survey Water-Supply Paper 427.* Washington, D. C., 1918.

PORTER, J. G. **All-American time: A scientific time system for the United States.** 7 pp.; map. *Univ. of Cincinnati* [*Publs.*], Ser. 4, Vol. 1, 1918.

SHAW, E. W. **Ages of peneplains of the Appalachian province.** *Bull. Geol. Soc. of Amer.,* Vol. 29, 1918, No. 3, pp. 575-586.

SMITH, GEORGE O. **A century of Government geological surveys.** *Amer. Journ. of Sci.,* No. 271, Ser. 4, Vol. 46, 1918, July, pp. 171-192. New Haven.

SMITH, MIDDLETON, O. E. BAKER, AND R. G. HAINSWORTH. **A graphic summary of American agriculture.** Maps, diagrs. *Yearbook of Dept. of Agric. for 1915,* pp. 329-403. Washington, D. C., 1916. [See the reference in the May, 1919, *Review,* p. 345.]

—— **U. S. Geographic Board, Decisions of the, July, 1916-July, 1918.** 34 pp. Washington, D. C., 1919.

—— **U. S. Geographic Board, Decisions of the.** 7 pp. Washington, D. C., 1919. [Including decisions of the Philippine Committee on Geographical Names, approved by the U. S. Geographic Board, Dec. 4, 1918.]

WARD, R. DEC. **The larger relations of climate and crops in the United States.** Map, bibliogr. *Quart. Journ. Royal Meteorol. Soc.,* No. 189, Vol. 45, 1919, pp. 1-19 (discussion, p. 19). London. [See the note in the May, 1919, *Review,* p. 345.]

North Atlantic States

CHAMBERLAIN, ALLEN. **Vacation tramps in New England highlands.** 164 pp.; maps, ills. Houghton, Mifflin & Co., Boston and New York, 1919. $1.25. 7 x 4½.

Here is an altogether charming account of walks over that most primitive of highways, as well as most poetic, the trail. Mr. Chamberlain takes his readers through the White Mountains of New Hampshire, the Green Mountains of Vermont, and the regions about Mt. Katahdin in Maine. The volume is in no sense a guidebook, although it serves that purpose admirably. Its appeal is quite as much to the stay-at-homes in quest of delightful and stimulating accounts of the high spots in our country. Mr. Chamberlain has a good deal of Thoreau's taste for tramping as well as a good deal of his art in communicating to others the joys of the wilderness trails.

After preliminary chapters dealing with the scenic worth of the New England highland and the pedestrian's kit, the author describes with rare fascination a summer sauntering afoot through the White Mountains, a journey from Johnson over the Sterling Mountains to Mt. Mansfield and the Couching Lion, a tramp along the Green Mountain Club's Long Trail from the Lincoln-Warren Pass over the Lincoln, Stark, and Burnt Mountain ranges, an autumn tour through the mountains of southern Vermont, midwinter trips to the roof of New England and the Mt. Washington region, and a summer camping tour to the little-known Katahdin country in Maine. Students of American geography, as well as all lovers of out-of-door life, will find much to interest them in Mr. Chamberlain's significant little volume. WILL S. MONROE

BIDWELL, P. W. **Rural economy in New England at the beginning of the nineteenth century.** Map, bibliogr. *Trans. Connecticut Acad. of Arts and Sci.*, Vol. 20, 1916, pp. 241-399. New Haven.

HARPER, R. M. **A sketch of the forest geography of New Jersey.** Map, ills. *Bull. Geogr. Soc. of Philadelphia*, Vol. 16, 1918, No. 4, pp. 107-125. [Valuable account, based on personal knowledge and on thorough familiarity with the available phytogeographical literature. The state is divided into nine natural regions, shown on a map, viz: Kittatinny Mountain, Kittatinny Valley, the Highlands, the Triassic Region, the Greensand Marl Belt, the Pine Barrens, the Cohansey Region, the Cape May Region, and the Coast Strip. The forest geography of each region is briefly characterized, a "quantitative analysis," in the author's customary manner, being given of the predominant trees in each region, also the percentage of forested area, based mainly on Vermeule in the 1899 forest report of the State Geological Survey. The relation of forest growth to soils receives the attention it deserves, in which connection it is of interest to note that the author believes that "the existing differences between the vegetation of the Pine Barrens and that of the surrounding country are so obviously correlated with present soil conditions that it seems quite unnecessary to invoke" a Pensauken submergence "to explain them."]

MUNRO, W. H. **Tales of an old sea port.** 292 pp.; ills., index. Princeton University Press, Princeton, 1917. $1.50. 8½ x 6. [Chiefly personal narratives of voyages made by sailors from Bristol, R. I. They include the voyage of the *Juno* by Captain John De Wolf, "A Voyage to the North Pacific and a Journey through Siberia more than half a century ago," printed in Cambridge, 1861.]

—— **New Jersey, State of: Census of 1915.** 98 pp. Dept. of State, Trenton, N. J., 1916.

—— **New York, State of: State Commissioner of Highways, Report of the, [for 1915.]** 939 pp.; maps, ills., index. J. B. Lyon Co., Albany, 1916. [Chiefly statistical in character, with some good photographic illustrations. Of geographical interest is the section on maps, page 19, in which we learn that the Department of Highways has been preparing a map of the state which will show completed state and county highways and also the true condition of those under contract. The map is being prepared in such a way that it can be added to as contracts are finished. Pending the completion of this fundamental map, two simpler maps on the scale of 1:570,000 have been issued, copies of which accompany the present report. The first shows the legal status of the state and county highways, the second, the physical condition of state, county, and town roads and the location of points of historical interest along them.]

—— **New York, The greater port of.** Ills. *Dun's Rev.: Internatl. Edit.*, Vol. 29, 1917, No. 2, pp. 36-38 and 49.

—— **New York Central Railroad, The, 1831-1915.** 31 pp.; ills. New York Central Railroad, [New York], 1916. 8 x 5½.

—— **New York's multitudes, Moving.** Ills. *Dun's Rev.: Internatl. Edit.*, Vol. 27, 1916, No. 2, pp. 35-38. [Gives Police Department figures for street traffic of New York City. The four busiest points, with the traffic in a ten-hour day, are: western end of Brooklyn Bridge, 300,000 pedestrians and 7,000 vehicles; Broadway and Fulton Street, 233,000 pedestrians and 10,300 vehicles; Fifth Avenue and 34th Street, 140,000 pedestrians and 14,300 vehicles; Fifth Avenue and 42nd Street, 114,000 pedestrians and 18,800 vehicles. See also section and diagrams on traffic in E. P. Goodrich's article in the September, 1916, *Review* (Vol. 2, pp. 201-204).]

—— **Pennsylvania, Descriptive review showing development of the state of; containing in addition newly engraved maps of every state in the United States, and detail maps of every county, state, and kingdom, together with a complete locating index to all cities, towns, villages, and post offices in the United States, giving populations to every incorporated city and village therein.** 374 pp.; maps (107 pp.), ills. George F. Cram Co., Chicago and New York, 1917. 15 x 12. [A gazetteer of counties, cities, boroughs, and villages.]

Perkins, G. H. **The physiography of Vermont.** *Science,* No. 1256, Vol. 49, (N. S.), 1919, January 24, pp. 77-81.

Sauer, C. O. **The role of Niagara Falls in history.** Map, ills. *Hist. Outlook,* Vol. 10, 1919, No. 2, pp. 57-65. Philadelphia. [Abstracted in the *Journ. of Geogr.*, April, 1919, pp. 158-159.]

—— **United States coast pilot: Atlantic coast, Section B, Cape Cod to Sandy Hook.** 326 pp.; maps, index. *U. S. Coast and Geodetic Survey Serial No. 91.* Washington, D. C., 1918.

—— **White Mountains and adjacent regions, Guide to paths in the (revised 1917).** xi and 424 pp.; maps, index. Appalachian Mountain Club, Boston, Mass. 6 x 3½. [The standard mountaineering guide of this region. There are 8 sectional contour maps on the scale of 1:160,000, reproduced in heliotype, bound in the book; 4 text maps, including two showing Mt. Monadnock and Mt. Katahdin; and 2 folded maps in a pocket, one of the Mt. Washington Range, 1:62,500, contour interval 100 feet (heliotype), and the other of the northern peaks of the range, 1:40,000, contour interval 100 feet (lithograph; contours in brown, drainage in blue, rest in black).]

—— ***Long Island Sound, North Shore of, Milford to Stratford, including Housatonic River, Connecticut.*** 1:20,000. U. S. Coast and Geodetic Survey Chart No. 219. Washington, D. C., Feb., 1919.

—— ***Bangor and Brewer, Maine, A survey of.*** Based on records and plans in the City Engineer's Office. [1 inch to 800 feet, or 1:9,600.] The National Survey Co., Portland, Me., 1914.

—— [***New England states and New York, Maps of.***] (1) ***The official map of Maine.*** [1 inch to 7 miles, or 1:443,520.] (2) ***The official map of Vermont and New Hampshire.*** [1 inch to 4½ miles, or 1:285,120.] (3) ***The official map of Southern New England, comprising Massachusetts, Connecticut, and Rhode Island.*** [1 inch to 4½ miles, or 1:285,120.] (4) ***The official map of New York.*** [1 inch to 7 miles, or 1:443,520.] ***Compiled from United States government surveys, official state surveys, and original sources.*** The National Survey Co., Chester, Vt., 1915, 1918. [Carefully compiled and neatly drawn maps. No relief is shown, but the locational elements are given in great detail. Four classes of roads are distinguished, trolley lines are shown, and there is great refinement in the notation of the status of towns or villages, no less than thirteen symbols being used to indicate the existence of post, telegraph, and express offices, country stores, and banks.]

—— ***New York, Canal map of the state of.*** [1 in. to 12½ miles, or 1:762,000.] Inset: Profile of Barge Canal, 1 in. to 15 miles. State Engineer and Surveyor, Barge Canal Office, Albany, N. Y., 1918.

South-Central States

Snider, L. C. (and others). **Geography of Oklahoma.** *Oklahoma Geol. Survey Bull. No. 27.* 325 pp.; maps, ills. Norman, 1917.

This is a very creditable piece of work, considering the short time Oklahoma has been inhabited by civilized man, and it gives a better account of the local geography than we have at present of many much older states. The fact that most of the inhabitants of Oklahoma were born in other states, a few to several hundred miles away, and have thus had experience with different environments, has probably had a stimulating influence on geographical research in that state. The principal author was assistant director of the Oklahoma Geological Survey in 1913-14, but several of the chapters were contributed or revised by others after he left the state. This makes the treatment a little uneven.

Of the three large maps (printed in black and white on paper too thin to stand much handling) the first is an ordinary political map, the second a geological map, and the third, called a "physiographic map," is a map of the geographical regions. The half-tones are well selected to illustrate the scenery and resources; but, being printed in the text (though erroneously called plates) on rather cheap paper, they are not very brilliant.

About 11 pages are devoted to boundaries, topography, and drainage, 9 to climate, and 15 to geology. Then follows the portion of chief interest to geographers, Chapter 3, on ''physiographic provinces.'' These are eleven in number and correspond in a general way with geological formations. About three pages on the average are devoted to each region, about half the space being taken up with stratigraphy and the rest with topography, drainage, soil, vegetation, population, etc.

Then follow several chapters in which the geographical point of view is not very prominent, including 38 pages on mineral resources, 12 on agriculture, 9 on history, 30 on educational institutions, 30 on animals (nearly half of which is a bare list of species without localities), 32 on plants (with an annotated list of trees and shrubs, condensed from Circular 4 of the same organization, published about five years earlier but containing many cultivated species and some others whose occurrence in Oklahoma seems very improbable), and finally a brief sketch, about a page in length, of each of the 77 counties.

The eleven regions, beginning with the northeasternmost, are the Ozark, Ouachita, Arbuckle, and Wichita Mountains, the Red River Valley, or Cretaceous region (a part of the coastal plain, being the northward extension of the black prairies of Texas), the Lower Arkansas Valley, the Sandstone Hills (continuous with the flint hills of Kansas), the Prairie Plains, the Red Beds Plains, the Gypsum Hills, and the High Plains. Two of these, the Arbuckle and Wichita Mountains, are small unique regions confined to Oklahoma, and the former is noteworthy for containing a number of travertine falls, which have been described in a separate bulletin (*Bull. 29*). The regions all seem to differ as much in soil, vegetation, etc., as they do in topography.

The principal mineral resources seem to be oil and gas, coal, sandstone, clay, and gypsum, and the leading crops corn, cotton, wheat, alfalfa, broom corn, and kafir corn. The commonest tree in the state is said to be the blackjack oak (*Quercus marilandica*); and hardwoods greatly predominate over conifers, on account of the prevailingly fertile soils. The greater part of the state is treeless, however, the forests being chiefly in the eastern third.

The bulletin has no chapter specially devoted to population, and no index; but the table of contents is conveniently arranged, and the county descriptions are in alphabetical order.
ROLAND M. HARPER

—— ***Gulf Coast, Galveston to Rio Grande.*** [1:460,000.] U. S. Coast and Geodetic Survey Chart No. 1117. Washington, D. C., March, 1919.

—— ***Lakes Pontchartrain and Maurepas, Louisiana.*** 1:80,000. U. S. Coast and Geodetic Survey Chart No. 1269. Washington, D. C., Feb., 1919.

—— [***Topographic map of the United States.***] ***Camp Taylor and Vicinity, Ky.*** 1:62,500. U. S. Geol. Survey, Washington, D. C., 1918. [With account of "The Country in and Around Camp Taylor," by Charles Butts, on the back of the sheet.]

WEST INDIES

BOOY, THEODOOR DE, AND J. T. FARIS. **The Virgin Islands: Our new possessions and the British islands.** 292 pp.; maps, ills., bibliogr., index. J. B. Lippincott Co., Philadelphia and London, 1918. $3.00. 8½ x 5½.

The picturesque story of ''The Virgin Islands of the United States'' was briefly told by the late Mr. de Booy in the *Review* (Vol. 4, 1917, pp. 359-373). In this volume, of which Mr. de Booy was joint author, it is told in detail, and there is added a chapter on the British islands that geographically are members of the group. The chief material used in preparation of the book was gathered by Mr. de Booy during his archeological explorations for the Museum of the American Indian, Heye Foundation. To his archeological labors, of much scientific interest, reference here is made merely to complete the historical picture, for the book has been designed particularly for the tourist and the business man. With their needs in view have been added a chapter of ''Hints for the Tourist'' and another of statistical information. The bibliography also will be found useful.

ZABRISKIE, L. K. **The Virgin Islands of the United States of America: Historical and descriptive, commercial and industrial facts, figures, and resources.** xvii and 339 pp.; maps, index. G. P. Putnam's Sons, New York and London, 1918. $4.00. 8½ x 6.

Discovered by the great Genoese admiral in the employ of Spain, settled by Dutch, English, and French, owned by Denmark for 250 years, peopled at present almost entirely by Africans who speak the English language, and now under the American flag, though at one time courted and probably almost won by Germany with her scheme of commercial expansion; once the entrepôt of ships from every nation, later almost forgotten in an unfrequented nook of the Caribbean; today once more destined to play an important rôle as guardian to the world's new gateway—this is the story of the Virgin Islands. With an area of only 139 square miles, few natural resources, and a population of but 27,000 people, these islands cost the United States more than the Louisiana Purchase and Alaska combined, and many Americans have wondered if the bargain was worth while.

The present volume does not attempt to answer that question fully. More space is given to details of the commercial situation, port regulations, currency, and means of communication than to the strategic importance of the islands or the suitability of their harbors as a naval base. The author, former vice consul of the United States at St. Thomas, writes almost entirely from a commercial viewpoint. The book will serve as a useful guide to any person who may contemplate trade or investment in these recently acquired possessions. It tells, too, of many incidents connected with the purchase and transfer of the islands from Denmark to the United States, giving, besides, a sympathetic description of the inhabitants and their ways of life. This should render it of a certain permanent historical value. The excellent illustrations help to compensate for a rather hasty composition and faulty editing.

Aspinall, A. E. **The pocket guide to the West Indies: British Guiana, British Honduras, the Bermudas, the Spanish Main, and the Panama Canal.** New edit. 488 pp.; maps, ills., index. Rand, McNally & Co., Chicago and New York, 1914. $1.50. 7 x 4.

Booy, Theodoor de. **On the possibility of determining the first landfall of Columbus by archaeological research.** *Hispanic Amer. Hist. Rev.*, Vol. 2, 1919, No. 1, pp. 55-61. Baltimore.

Cabon, Adolphe. **Contribution à l'étude de la géographie d'Haïti: Notes bibliographiques sur la géographie d'Haïti. (1) Bibliographie de la géographie de l'île au temps de la colonie espagnole, 1492-1630, (2) Bibliographie de la géographie de l'île d'Haïti au temps de la colonie française, 1640-1789, (3) Note sur la cartographie d'Haïti.** *Bull. Semestriel de l'Observ. Météorol. du Séminaire-Collège St-Martial*, 1916, July-Sept., pp. 149-174. Port-au-Prince, Haiti.

Cabon, Adolphe. **Notes historiques sur la détermination de la position géographique d'Haïti.** *Bull. Semestriel de l'Observ. Météorol. du Séminaire-Collège St-Martial*, 1916, Jan.-June, pp. 51-67. Port-au-Prince, Haiti.

Hall, Maxwell. **West Indies hurricanes as observed in Jamaica.** Map, diagrs., ill. *Monthly Weather Rev.*, Vol. 45, 1917, No. 12, pp. 578-588.

Harris, Garrard, and various American consular officers. **The West Indies as an export field.** 378 pp.; map, ills., bibliogr. *U. S. Dept. of Commerce Special Agents Ser. No. 141.* Washington, D. C., 1917. [This report contains a good general description of each island, including even such minor groups as the Cayman, the Dutch West Indies, and the British Virgin Islands. Situation, climate, soil, resources, population, means of communication, etc., are considered. A list of recent books on the West Indies and of Department of Commerce monographs covering the same field forms the appendix.]

Jones, William F. **A geological reconnaissance in Haiti: A contribution to Antillean geology.** Diagrs., ills. *Journ. of Geol.*, Vol. 26, 1918, No. 8, pp. 728-752. [Contains a section on topography and, on the insert plate, a small but clear map showing the topographic divisions of the island of Haiti.]

Ortega, Pablo. **Petroleum in Cuba.** Ills. *The Cuba Rev.*, Vol. 16, 1918, No. 11, pp. 17-23. New York.

EUROPE

Scandinavia, including Finland

Madsen, V. H. O., edit. **Den Danske Gradmaaling. No. 11: Konstantbestemmelser ved relative Pendulmaalinger.** 115 pp.; diagrs. **No. 12:** V. H. O. Madsen and N. P. Johansen. **Astronomisk Bestemmelse af Laengdedifferensen mellem Kjøbenhavns Observatorium og Buddinge samt af Azimuthet i Buddinge af Retningen mod Nikolaj Taarn.** 115 pp. **No. 13:** V. H. O. Madsen and N. M. Petersen. **De danske Kysters Middelvandstande og disses Reduktion til "stille" Polhøjdevarationens Indflydelse.** 118 pp.; diagr. **No. 14:** V. H. O. Madsen and Aage Petersen. **Registeringsapparat til Tyngdemaalingspenduler.** 14 pp. **No. 15:** V. H. O. Madsen and M. J. Sand. **Nye Basismaalinger i Danmark.** 84 pp.; diagrs. Copenhagen, 1913-1916.

Under General Madsen as Director the Danish Coast and Geodetic Survey has now brought up to date the published record of its accomplishments during the hundred years of its existence. The volumes are excellently printed and contain maps and diagrams to illustrate the different phases of the work.

In Volume 11 is found a discussion of the measurements of the intensity of gravity. The Danish Fechner apparatus had been sent to Potsdam to determine the pendulum constants necessary for a reduction of observations to a vacuum at 0° C. in 1904, and, some doubt of the validity of these reductions having arisen, a new determination with improved electrical thermostat was made in 1913. A satisfactory formula finally resulted, and graphical methods were introduced to facilitate approximate determinations.

The first part of Volume 12 contains the determination of the difference in longitude between the observatory of Copenhagen and Buddingen, with a detailed description of stations and methods. The second part discusses a determination of an azimuth at Buddingen and a critical analysis of the mean error of the results.

Volume 13 contains a rehandling of the results of sea-level determinations. The periodic annual variation was determined and the relation of barometric heights under the La Cour hypothesis.

Volume 14 contains a description of a device for registering photographically on the cylinder of a chronograph the curves obtained from the swinging of pendulums.

In Volume 15 are found two new base measurements. The triangulation of Denmark depends upon the Copenhagen base measured by Schumacher in 1838. The new determination in 1911 with a Jäderin apparatus gave a length of 51 millimeters, or 1/53,000 greater. In order to be sure that the discrepancy was not due to systematic error, the Potsdam auxiliary base was measured ten times and the Prussian value checked to 1/3,000,000. In 1913 another Danish base was measured and the result checked to 1/1,000,000, with its length computed from the work of 1838. This indicates that the old work may be accepted and that the length of the Copenhagen base has changed since 1838, the reason for which will have to be determined by subsequent research.

JAMES GORDON STEESE

FØYN, N. J. **Das Klima von Bergen. Part II: Lufttemperatur.** *Bergens Museums Aarbok 1915-16: Naturvidenskabelig Raekke No. 4,* pp. 1-88.

HOWORTH, H. H. **The recent geological history of the Baltic and Scandinavia and its importance in the Post-Tertiary history of western Europe.** *Geol. Mag.,* Decade 6, Vol. 5, 1918, No. 8, pp. 354-367; No. 9, pp. 397-409; No. 10, pp. 451-461. London.

OSTENFELD, C. H. **Randersdalens Plantevaekst.** Pp. 155-270; maps, ills. Extract from "Randers Fjords Naturhistorie," Ch. 4. Bianco Lunos, Copenhagen, 1918. [Part of a study of the plant ecology of the Randers Firth on the east coast of Denmark.]

THORODDSEN, THORVALDUR. **Árferdi á Íslandi í thúsund ár.** Part I: 192 pp. Part II: pp. 193-432. Íslenska Fraedafjelagi í Kaupmannahöfn, Copenhagen, 1916, 1917. 9 x 6. ["The Seasons in Iceland for a Thousand Years." Mainly a compilation from contemporary observations on the weather for the period 865-1900, with critical comment.]

WALLÉN, AXEL. **Sambandet mellan klimat och skörd i Sverige.** Maps, diagrs., bibliogr. *Ymer,* 1918, No. 1, pp. 1-23. Stockholm. [Relation between climate and crops in Sweden.]

WALLÉN, AXEL. **Sur la corrélation entre les récoltes et les variations de la température et de l'eau tombée en Suède.** 87 pp.; maps, diagrs. *Kungl. Svenska Vetenskapsakademiens Handlingar,* Vol. 57, 1917, No. 8. Stockholm.

SPAIN, PORTUGAL

BARANDICA Y AMPUERO, MANUEL DE. **Determinación relativa de la intensidad de la fuerza de gravedad en Roldán, Cartagena y Torrejón.** 66 pp.; diagrs. *Memorias Inst. Geogr. y Estadíst.,* Vol. 14, No. 1. Madrid, 1914.

BLÁZQUEZ, ANTONIO. **Mapas antiguos adquiridos por la Sociedad Bilbaína y un mapa de Juan Oliva, de 1591.** Ills. *Bol. Real Soc. Geogr.,* Vol. 60, 1918, No. 2, pp. 207-230. Madrid. [Old maps of Spain.]

CARANDELL, JUAN, AND JOAQUÍN GÓMEZ DE LLARENA. **El glaciarismo cuaternario en los Montes Ibéricos.** 62 pp.; maps, diagrs., ills., bibliogr. *Trab. Museo Nacl. de Cienc. Nat., Ser. Geol. No. 22.* Madrid, 1918. [The Iberian Mountains between the Spanish Meseta and the Ebro Valley.]

GALBIS Y RODRÍGUEZ, JOSÉ. **Determinaciones relativas de la intensidad de la gravedad.** 133 pp.; diagrs., ills. *Memorias Inst. Geogr. y Estadíst.,* Vol. 14, No. 2. Madrid, 1918. [All the stations occupied are in Spain.]

Gavala y Laborde, Juan. **Descripción geográfica y geológica de la Serranía de Grazalema en la provincia de Cádiz.** Maps, diagrs., ills. *Bol. Inst. Geol. de España,* Vol. 39 (Vol. 19, 2nd Ser.), 1918, pp. 3-143. Madrid.

Kindelan, Vicente. **Criaderos de hierro de las provincias de Guadalajara y Teruel.** Maps, diagrs., ills., bibliogr. *Memorias Inst. Geol. de España,* Vol. 3, pp. 1-176. Madrid, 1918.

Lucci, L. F. de L. S. **Estudos geográficos: Alterações litorais a ria de Aveiro.** 70 pp.; map, bibliogr. Lisbon, 1918. 9 x 6½. [Portugal.]

Merino, Abelardo. **El regionalismo peninsular: La antropología y la etnografía.** *Bol. Real Soc. Geogr.,* Vol. 60, 1918, No. 2, pp. 137-206. Madrid. [Anthropology and ethnography of Spain.]

Michavila, Antonio. **La barraca valenciana.** Ills. *Rev. de Geogr. Colon. y Mercantil,* Vol. 15, 1918, No. 8-10, pp. 281-330. Real Soc. Geogr., Madrid. [Those who have found delight in Blasco Ibañez's "The Cabin" will doubly appreciate this geographical interpretation of life in the Vega of Valencia.]

Navarro, Benjamín. **El Valle de Carriedo.** Maps, ills. *Iberica,* No. 238, Vol. 10, 1918, July 27, pp. 75-79; No. 243, Sept. 14, pp. 154-157. Tortosa. [A mountain basin on the seaward slope of the Cantabrian Mountains south of Santander.]

—— **Real Sociedad Geográfica: Anuario de 1919.** 87 pp. Madrid, 1919. 4½ x 3½.

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ERRATA

p. 52, line 13 from bottom: *for* Bridgewater *read* Bridgeport.
p. 68, line 17 from bottom: *for* Schultz *read* Schulz.
p. 118, Fig. 1, main map: *for* Scale 1:6,300,000 *read* Scale 1:8,000,000.
p. 118, Fig. 1, lower right inset: *for degrees of latitude* 84, 83, 82, 81, 80 *read* 83½, 83, 82½, 82, 81½.
p. 144, line 17: *for* in Norwegian and English *read* in Danish and English.
p. 145, line 6 of footnote: *for* Rato *read* Raton.
p. 152, Fig. 5: *supply location:* southern end of Johnson Mesa.
p. 194, line 23 from bottom: *for* besides *read* beside.
p. 199, line 8: *for* Foreward *read* Foreword.
p. 204, line 6 under "China": *for* Cheng, Shi-Gung *read* Cheng, Sih-Gung.
p. 238, Fig. 5: *scale in legend under map should read, as on map,* 1:19,000,000.
p. 254, line 2 from bottom: for *carrapanás* read *carapanás*.
p. 270, line 7 from bottom: *for* zuruckgezogen *read* zurückgezogen.
p. 276, line 1 of table: *for* Puu Kuki *read* Puu Kukui.

Additional Errata in Previous Volumes

Vol. I

p. 448, line 1 of footnote 2: *for* Vol. 65, No. 8, *read* Vol. 51, No. 8.

Vol. II

p. 66, line 16: *for* Lange Koch *read* Lauge Koch.

Vol. IV

p. 73, line 32: *for* efectuades *read* efectuadas.
p. 157, line 15 from bottom: *insert* for 1915 *before* No. 604.
p. 174, line 26: *for* manganese *read* magnesium.
p. 189, line 17 from bottom: *for* Caravaya *read* Carabaya.
p. 195, line 5: *for* Caravaya *read* Carabaya.
p. 227, line 3: *for* zwangstigsten *read* zwanzigsten.
p. 240, line 1: *for* Northrup *read* Northup.
p. 375, line 9 from bottom: *for* seer *read* sere.
p. 507, col. 1, line 46: *for* zwangstigsten *read* zwanzigsten.
p. 511, col. 1, line 22 from bottom: *dele entry:* Brooks, A. H., 404.
p. 529, col. 1, line 34: *for* zwangstigsten *read* zwanzigsten.